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King Fire Restoration Project

Volume 2 - Appendices

Eldorado National Forest
El Dorado and Placer Counties, California

View of Rubicon Canyon in the King Fire
Courtesy of Placer County Water Agency

Draft Environmental Impact Statement
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Appendix A
King Fire Ecological Analysis – Comparison to Natural Range of Variability

Becky Estes
USDA Forest Service, Pacific Southwest Region
Central Sierra Province Ecologist
100 Forni Road
Placerville, CA 95667

Shana Gross
USDA Forest Service, Pacific Southwest Region
Associate Central Sierra Province Ecologist
35 College Drive
South Lake Tahoe, CA 96150

Summary

The ecological condition of the mixed yellow pine conifer forests in the King Fire, Eldorado National Forest were evaluated using the Natural Range of Variability (NRV) concept. Using this approach, NRV was compared to current conditions determined from existing data. Compared to NRV, current mixed-conifer stands in the King Fire are generally characterized by: 1) a greater proportion of high severity fire, 2) a lower proportion of low and moderate fire, 3) larger patches of high severity fire, 4) departure from the pre-European fire return intervals, and 5) a greater amount of early-seral conditions. These conditions were than compared to the current proposed alternatives that treat the King Fire landscape at varying levels.

Cover Photo: This image was taken on October 1, 2014, from a reconnaissance flight to evaluate fuel treatment effectiveness in the King Fire. The image is looking 350° along the Rubicon drainage. This area burned on the 17th of September under extreme conditions, resulting in widespread complete consumption of conifers, hardwoods, and shrubs.

Introduction

King Fire Background

On Saturday, September 13, 2014, the King Fire began at approximately 3,000 feet elevation along Forebay Road near the town of Pollock Pines, CA, on the State District Protection Authority. The fire quickly spread onto the Eldorado National Forest (ENF) into steep, rugged terrain (slopes of 100% and greater) through the South Fork of the American River drainage before burning through the Rubicon drainage covering a total of 97,717 acres (39,544 hectares) (Figure 1). The fire burned on the Placerville, Pacific, and Georgetown Districts of the ENF, El Dorado and Placer Counties, a small portion of the American River District on the Tahoe National Forest (TNF), as well as private lands.

During the time period of September 13th-16th, the fire grew approximately 4,000 acres each day with a final growth on the 16th along three fronts totaling 8,000 acres. Weather conditions during this time were approximately in the 90th percentile. On September 17th-18th, fire behavior and growth were extreme with the burned area expanding over 50,000 acres. Early morning, Bald Mt. RAWS showed the RH significantly lower than previous days at 25 percent. At 0800, sustained winds were from the south at 20+ mph. This spread event was likely the product of several elements: drought-stressed fuels, very heavy fuel loadings, alignment with terrain features, exceptionally low relative humidity, and fairly unstable air mass. Peak fire behavior was estimated to be 100-150 chains per hour, 50-100 foot flame lengths, with crown fire runs, pyro-cumulus development, and a spotting distance of 2-3 miles. The time following the 18th of September, the King Fire grew to the final size of 97,717 acres, burning in varying conditions ranging from 2,400 acres of growth to 5,500 acres of growth.

Managing Within the Bounds of the Natural Range of Variability

Effective ecosystem management requires both explicit management goals and an understanding of the conditions and processes that maintain ecosystem integrity over time (Veblen and Donnegan 2005). Ecosystems are recognized as dynamic, exhibiting temporal and spatial variability at various scales providing new challenges and opportunities for land management. It is generally understood that efforts to achieve ecosystem sustainability and persistence are likely to be more successful if they maintain ecosystems within the bounds of natural variation rather than targeting a static equilibrium condition from some point in the past (Wiens 2012). It is important to understand that natural variation is not restricted to historical conditions, but rather is a characterization of the natural variation before major Euroamerican settlement of California in the middle of the 19th century and contemporary landscapes that have a more active fire regime. In the draft land management planning handbook, chapter 10 (FSH 1909.12.10.5), the Natural Range of Variation (NRV) is defined as:

> "Natural Range of Variation (NRV) [is the] spatial and temporal variation in ecosystem characteristics under historic disturbance regimes during a reference period. The reference period considered should be sufficiently long to include the full range of variation produced by dominant natural disturbance regimes, often several centuries, for such disturbances as fire and flooding and should also

> include short-term variation and cycles in climate. "Natural range of variation" is a term used synonymously with historic range of variation or range of natural variation. NRV is a tool for assessing ecological integrity, and does not necessarily constitute a management target or desired condition. NRV can help identify key structural, functional, compositional, and connectivity characteristics, for which plan components may be important for either maintenance or restoration of such ecological conditions."

Following the draft land management planning handbook (FSH 1909.12.10.15), the goal is to assess the ecological conditions and integrity of the King Fire area immediately post-fire and in the five alternatives proposed in the King Fire Restoration EIS using the following steps:

1. Describe the ecological conditions that would sustain ecosystem integrity relevant to the key characteristics, which will be evaluated using the NRV.
2. Describe the current ecological conditions relevant to the key ecosystem characteristics immediately post-fire.
3. Compare the present condition of the selected key ecosystem characteristics to those that would sustain ecosystem integrity to determine the status of each key ecosystem characteristic.
4. Evaluate the proposed alternatives in the King Fire Restoration EIS and provide a comparison between them and NRV.

Limitations of the NRV concept as a means to determine desired conditions do exist. The interpretation of NRV is limited by the data that is available to determine the NRV. This is recognized by acknowledging the level of confidence for each variable that is assessed. The impact climate has on reference conditions can also limit the relevance of historic data. This has been addressed by also drawing from current reference conditions (e.g., Yosemite National Park) to determine NRV as these are more representative of the current climate conditions. Finally, NRV does not incorporate information related to the social range of acceptability. The NRV information is most effective as a tool to identify key processes and their influence on structure, composition and function of ecosystems rather than a way to determine a fixed target over time (Safford 2013).

Methodology

Data Gathering Methods and Analysis

In order to collect information on the current ecological conditions within and surrounding the King Fire, data was assembled using existing datasets detailed within the "King Fire Vegetation Resiliency and Restoration Assessment" (Walsh et al. 2015). This document was assembled by forest specialists to help guide the decision-making process. These data detail information that could be used for landscape analysis; for example, existing vegetation composition and structure, the Wieslander vegetation composition and structure plots, and bioclimatic modelling. This information, when appropriate, was used in this analysis as a comparison to NRV.

Fire severity is defined as the direct effects of fire on a resource and is most often defined by the degree of soil heating or mortality of vegetation. Fire severity, in this case, is determined by utilizing pre- and post-burn images obtained by the Landsat Thematic Mapper (Bands 4 and 7), approximately one month and one year after the fire. Fire severity in this document is referencing the Rapid Assessment of Vegetation Condition after wildfire which is the immediate post-fire composite burn index map (RAVG 2013). Both the percent change in basal area and the composite burn index generated from RAVG were used to provide an index to compare the magnitude of fire effects across the King Fire. This methodology has been rigorously ground-truthed using the composite burn index field sampling protocol (Key and Benson 2006) and has been sufficiently peer reviewed for the Sierra Nevada (Miller et al. 2009).

In order to compare fire severity in the King Fire to the NRV, the seven-class percent change in basal area was classified as Unchanged (0% change), Low (0-25% Change), Moderate (25-90% Change), and High (>90%) severity for each of the alternatives and the Composite Burn Index (CBI) was classified into four classes as Unchanged (0%), Low (0-25%), Moderate (25-90%), and High (>90%) severity. Fire severity data (percent change in basal area) was considered high severity when the percent change in basal area exceeded 90 percent. All high severity patches with some conifer dominance (including mixed hardwood conifer) were considered to allow easy comparison to the NRV document for yellow and mixed conifer forest developed by Safford (2013).

To develop a comparison of current conditions with the NRV we first had to determine the NRV for mixed conifer forests in the Central Sierra Nevada and the greater Sierra Nevada. We carried out a comprehensive evaluation of the NRV information for Sierra Nevada mixed conifer forests. Our information sources included historical inventory data, contemporary reference information, modelling approaches, and other historical accounts to describe the NRV for key ecosystem characteristics, including the function, structure, and composition of mixed conifer forests (Table 1). Only ecosystem characteristics with sufficient NRV or current information were considered for analysis. The variables that were analyzed were also those that were directly affected by the fire and were important in planning efforts. We focused our characterization of the NRV for mixed conifer forests at the stand scale, but also included an evaluation at the landscape scale for select functional variables that operate at larger spatial scales (e.g., fire regime). We included data from peer reviewed sources as well as USDA Forest Service data (e.g., Region 5 FRID database) and technical reports. Although our focus was on the King Fire, we also used published sources from neighboring regions when we determined that such information was applicable, suitable, and complementary (e.g., information specific to the bioregion was limited). For more details on the methodological approach for selecting NRV information for this assessment, refer to (Romme et al. 2012; Safford 2013).

We compared NRV and current conditions in mixed conifer forests in the Sierra Nevada relying heavily on current conditions in the King Fire. We used a simple graphical contrast of the means and standard deviations of ecological characteristics when possible. These comparisons represented simple, generalized differences or similarities in ecological characteristics that required a certain degree of subjective interpretation. Summary statistics for NRV stands were primarily calculated from the mean values of data sources noted above; thus, values represent the overall mean and variance and not the full range of ecological variation among NRV data sources. When possible, we also compared the NRV to proposed alternatives within the King Fire EIS. The major differences were the area treated, the types of treatments being applied and the amount of snag retention within each alternative. Alternatives 2, 4, and 5 were based on 10 percent of the Forest Resiliency Areas and Strategic Fuel Management Zones being retained as snag patches, and Alternative 3 was based on 20 percent of the same areas being retained.

The amount of early-seral coniferous forests in each class was determined by taking the initial conifer/mixed conifer hardwood dominated high severity patches and removing the treated areas that would transition them from one type of early-seral condition to another. A rough estimate of snag retention patches were determined by using the proposed design criteria for each Alternative.

Results and Discussion

Function

Background: Fire Regime

Ecological disturbances such as fire can be classified according to their characteristics (e.g., frequency, size, season, intensity, severity, pattern). A “fire regime” describes the manner in which fires tend to occur in a given ecosystem, in a generalized sense and averaged over many fires over a long period of time. Fire regimes necessarily simplify a very complex phenomenon, but they are a convenient and useful way to better understand and manage wildland fire (Sugihara et al. 2006). Under pre-settlement conditions, yellow pine and mixed conifer forests in the Sierra Nevada supported fire regimes characterized by frequent, low to moderate (or “mixed”) severity fires (Skinner and Taylor 2006; Van Wagtendonk and Fites-Kaufman 2006). In this section, we summarize information available on the different components of the fire regime for forests before Euroamerican settlement and compare this to current conditions in the King Fire and, when possible, to the respective alternatives.

Percent High Fire Severity in the Landscape: NRV and Comparison to Current

Mixed conifer forests were characterized by frequent mixed severity fires (Collins and Stephens 2010; Perry et al. 2011). Forests with mixed-severity fire regimes are characterized primarily by their mixed patches of vegetation of varied age, resulting from complex variations in both fire frequency and severity and species responses. This variability that is created in these landscapes supports an intermingling of early- and late-seral communities that contributes to resiliency (Halofsky et al. 2011).

Historic accounts in yellow pine mixed conifer forests noted a dominance of low and moderate severity fire with only infrequent canopy mortality. Estimates of high mortality or stand replacement fire across the landscape in the late to early 1900s reported about five to eight percent in this condition (Leiberg 1902; Show and Kotok 1924). Both Safford (2013) and Meyer (2015) estimated the NRV for the Sierra Nevada drawing on a number of resources including reconstruction data, historic accounts, and contemporary forested landscapes. They estimated that the percent of burned area was 10-30 percent for unchanged, 31-58 percent for low severity, 15-35 percent for moderate severity, and 5-11 percent for high severity (Figure 2). These estimates are fairly robust in that they do draw on multiple data sources. These estimates also use a 90 percent threshold to indicate the transition from moderate to high severity fire.

Vegetative severity mapping of the King Fire showed that 46,000 acres (47%) of the landscape had high burn severity (>90% decrease in basal area) (Figure 1). Amounts of unchanged, low, and moderate severity were highly variable across the landscape (Figure 1). Differences were observed in fire severity patterns between September 17th and 18th (the one large growth day) and the remaining fire progression (Figure 3). Fire severity on September 17th and the 18th was highly influenced by prevailing weather conditions. Of the almost 55,000 acres burned during those two days, 71 percent of the area was initially categorized as high severity (Figure 3). Throughout the remaining days, fire severity was well distributed by severity type with only about a quarter of the area burning in high severity (Figure 3), an amount closely matching historic fire regime ratios (Safford 2013). Preliminary observations indicate that patterns of fire severity during this time period were influenced by vegetation type, fuel conditions, and topography.

The areas that burned under more benign weather in the King Fire (outside of the 17th) in the King Fire resulted in conditions aligned with NRV, low severity conditions (31-58% NRV, 38% King) and moderate severity conditions that (15-35 NRV, 20% King) (Table 2). Conversely, the area within the King Fire that burned on the 17th-18th of September burned well outside the range of variability with 71 percent of the landscape burning at high severity (Table 2). The entire fire was still heavily weighted toward high severity (47%) and was still below the NRV for unchanged and low severity fire (Table 2).

<u>Percent High Fire Severity in the Landscape: Comparison of Alternatives</u>

If no treatment was applied to the King Fire area, the proportion of fire severity would be similar to the discussion of current conditions in the fire. Unchanged, low, and moderate severity fire would be maintained at 53 percent and high severity would remain at 47 percent, irrespective of treatment on private lands (Table 3). The remaining alternatives would remove varying amounts of fire-killed canopy trees altering the post-fire severity proportions. These areas would likely transition faster to conifer dominated habitat which is an important value for a number of wildlife species dependent on mature forests. Despite these changes in the alternatives there will only be a modest reduction in the proportions of unchanged, low, moderate, and high severity across the landscape as compared to the existing conditions (Table 2).

<u>High Severity Patch Size in the Landscape: NRV and Comparison to Current</u>

In mixed conifer and yellow pine forests, high fire severity patches have increased in size, departing from the natural range of variability (Safford 2013). The NRV of high fire severity patches documented in the scientific literature for Sierra Nevada ponderosa pine and mixed conifer forests was strongly dominated by small patches less than 10 acres in size (Sudworth 1900; Show and Kotok 1924; Kilgore 1973; Skinner 1995; Weatherspoon and Skinner 1995; Skinner and Chang 1996; Minnich et al. 2000; Bradstock et al. 2010; Collins and Stephens 2010). Some portion of the landscape would have also been comprised of large patches, but these would have rarely exceeded 150 acres in size (Minnich et al. 2000; Collins and Stephens 2010).

The high severity (>90% mortality) conifer mixed patches covered 39,687 acres on both FS and non-FS lands (Figure 4). There were 1,446 patches within this area of which the median patch size was 0.67 acres and the mean patch size was 27 acres with a standard deviation of 505 acres (Table 4). High severity patch size mean within the King Fire is a close approximation of what Miller et al. (2012) found throughout recent fires in Sierra Nevada forests (30 acres in Miller et al. (2012) (Figure 4) . The minimum patch size (that could be detected) was 0.22 acre while the maximum patch size was 17,311 acres (Table 4). The total area burned was weighted heavily toward large patches; 88 percent of the total high severity area was in patches >150 acres, which only comprised 1.1 percent of the total number of patches (Table 4). The largest patch made up 44 percent of the total high severity patches (Table 4). Examples of the varying levels of severity and high severity patch sizes are shown in both Figure 5 and Figure 6.

High Severity Patch Sizes in Landscape: Comparison of Alternatives

The alternatives break up the continuity of the high severity patches in the northern portion of the fire (Figure 7). The number of patches increased across the fire in all alternatives as the treatments effectively break up the large patches into smaller patches (Table 5). Mean patch size ranged from 11 ± 81 acres to 23 ± 432 acres with a maximum range of 2,051-2,111 acres in the alternatives where treatments were proposed (Table 5). Alternative 1 still had a large maximum patch size of 13,661 acres which only reduced the high severity because of expected treatments on private lands leaving it remaining outside the range of variability (Table 5).

The remaining alternatives maintain a variable distribution of patches (Figure 7, Table 5). Patches under 10 acres covered 1,106-1,388 acres with Alternative 3 maintaining the highest amount of patches within NRV (Table 5). These patches are pretty well distributed across the project area in all alternatives (Figure 7). Patches that are 10-150 acres in size ranged from 2,856 acres to a maximum of 4,757 acres in Alternative 3 (Table 5). All alternatives maintained patches larger than 150 acres in size (considered to be outside of NRV) with Alternative 3 retaining the largest amounts and Alternative 4 retaining the smallest amounts over 150 acres in size (Table 5).

Fire Return Interval NRV and Departure (FRID)

Fire frequencies are often measured by fire return interval which is the number of years between fire events. Fire frequencies can be measured in a variety of methodologies. In order to get a robust estimate, we utilized Van de Water and Safford (2011) who conducted an exhaustive review of the published and unpublished literature to determine fire return intervals observed prior to significant Euroamerican settlement (i.e., the middle of the 19th century). The NRV for fire frequencies in the vegetation types found in the King Fire were drawn from estimates made for the Southern Cascades and Sierra Nevada. The mean FRIs ranged from 11-16 years in yellow pine and mixed conifer forests, and median FRIs ranged from 7-12 years. Mean minimum FRIs were around five years for both forest types, and mean maximum FRIs ranged from 40-80 years (Van de Water and Safford 2011, Safford 2013).

Fire return interval departure (FRID) is based upon fire history, vegetation types, and the pre-settlement fire regimes for those vegetation types as outlined above. The majority of the area, with the exception of some small portion of the south part of the King Fire, had no fire history since 1908 (Figure 8). On the southeastern border of the King Fire a number of fires have occurred over the last 50 years (e.g., Ice House, Cleveland, Freds) but only a portion of the King Fire burned into those previous burn scars.

Safford and Van de Water (2014) compared pre-Euroamerican settlement FRIs to FRIs from the last century of fire records in California, using a set of FRID metrics. Figure 9 shows one of these metrics, mean PFRID in the King Fire. Similar to the King Fire history, it can be seen that most of the assessment area is highly positively departed, which means that FRIs are much longer than under pre-settlement conditions. Over 90 percent of the King Fire area is greater than +33 percent departed meaning they have current FRIs that are at least 1.5 times longer than under pre-settlement conditions; areas greater than +67 percent departed have current FRIs that are at least three times longer than in pre-settlement times. To put this into perspective, yellow pine and dry mixed conifer forests within the King Fire supported mean pre-settlement FRIs of about 11 years according to Van de Water and Safford (2011), which means that an average of 9.1 fires would occur over any given period of 100 years. Areas in Figure 9 that are greater than 33 percent departed from this pre-settlement FRI have experienced three fires or fewer over the last century.

Structure

Proportion of Early-Seral Habitat: NRV and Comparison to Current

Surprisingly little empirical and quantitative documentation of successional patterns in the yellow pine mixed conifer forests has been published. The natural range of variability in this context was derived from historic accounts, reconstructions, reference conditions and robust succession transition models.

Show and Kotok (1924) reported on the area of the National Forests in northern California that supported “brushfields” in the early 1920s, which were seral chaparral stands that had resulted from (often human-caused) fires in previously forested areas. Their estimate of 11.1 percent of the landscape on six National Forests in the assessment area is slightly higher than the current area of montane and mixed chaparral that occurs on productive forestland on the same National Forests (8.6%) (Safford 2013). A reconstruction study in Kings Canyon National Park (YPMC-giant sequoia forest) estimated that 19 percent of the study area was occupied by shrubfields in the late 1800s. This proportion had dropped to 11 percent in the late 1970s (Bonnicksen and Stone 1982).

The LANDFIRE BpS models predict that, under the pre-settlement fire regime, 15-20 percent of the average yellow pine-mixed conifer landscape would have been in early-seral stages (herbs, shrubs, seedlings/saplings), about 35 percent in areas dominated by trees between 10-53 cm dbh (5-21”), and 45-50 percent in areas dominated by trees >53 cm dbh (>21”) (Safford 2013). Although these values were generated from a model, the estimates are comparable with the historic accounts and reconstructions. They are also consistent with the mean high severity distribution for an assessment of NRV in the Southern Sierra (8.5 ± 4.4 acres) and an assessment of resource objective fires (7.0 ± 4.3 acres) (Meyer 2015).

Without treatment and assuming that the private ownership doesn't alter their lands, the King Fire would be maintaining approximately 50 percent of the landscape in early-seral conditions.

Early-Seral Habitat Comparison of Alternatives

The alternatives are proposing to retain different levels across a gradient of early-seral coniferous conditions. Multi-structure early-seral conifer forest will retain such features as fire killed trees, native shrub habitat and conifer and hardwood natural regeneration. Single-structure early-seral conifer forest will remove fire killed trees but will retain natural regeneration and native shrub components. Variable density early-seral conifer forest will focus on actively restoring conifer forest using artificial regeneration but will focus on a variable planting strategy which will help to maintain some percentage of shrub cover.

The amounts of multi-structure early-seral conifer forest maintained in the various alternatives ranged from 35-41 percent of the high severity conifer/mixed hardwood conifer patches. This is roughly half of what is retained in Alternative 1. Alternative 3 will retain the most multi-structure early-seral conifer forest after accounting for snag retention patches with 41 percent (Table 7). Single-structure early-seral conifer forest will help to provide potential habitat for naturally regenerating vegetation and ranged from 4-6 percent across alternatives. Alternative 4 had the highest retention because of the increase in treated area where natural regeneration could be relied on. The remaining early-seral conifer condition would reintroduce conifers in a variable structure that would mimic natural regeneration spatial patterns. This approach would likely retain some percentage of shrub regrowth even outside of the snag retention patches. The amount of area retained ranged from 26-31 percent across the alternatives, which would be outside NRV (8.6-11.1%).

To compare the alternatives to NRV the multi-structure early-seral conifer forest total (including snag retention patches) were calculated as a percent of the total fire area and assessed as one component of the successional stages. Alternative 1 retains the most early-seral but exceeded the calculated NRV (25% Existing, 15-20% NRV) (Table 8). The remaining four alternatives ranged from 14-17 percent and all fall closely within the NRV maintaining sufficient area in an early-seral condition. The addition of other early-seral conditions (single-structure, variable density) would likely maintain more early-seral habitats across a gradient across the King Fire area that would provide important features for a number of dependent species.

Climate Effects

The few models that have been run to estimate the effects of climate on conifer dominated forests suggest increased transition of forest to chaparral, but increased transition of chaparral to grassland as well, both trends being driven by increased fire activity (Lenihan et al. 2008) (Figure 11). Cole (2010) studied paleoecological data from earlier periods of rapid climate warming in the Pleistocene and suggested that current and projected future warming trends could be expected to greatly increase the amount of early-seral vegetation on the landscape. McKenzie et al. (2004) noted that, given current and projected trends in climate and fire, the long-term persistence of late seral forest in much of the western US was questionable. Based on projections as well as trends already in play in southern California, it seems likely that – especially at lower elevations – some proportion of the YPMC forest belt will transition to shrubland and grassland over the next century (Safford 2013). It also seems likely that forest landscape structure will become gradually more coarse-grained as fire frequency and severity continue to increase and fire suppression efforts continue to lead to forest densification in the rest of the landscape. A high proportion of early-seral forests will occur on the landscape as future climate causes increased fire severity and frequency, therefore management efforts should focus on fostering mid- to late-seral stands.

Conclusions

The summary of NRV indicates that the King Fire resulted in conditions that exceeded the range (Table 9). Conditions after the fire showed altered proportions of fire severity, larger patches of high severity fire, and large areas that were reset to early-seral conditions (Table 9). Prior to the fire the departure from pre-European fire return intervals was high across the fire and will remain in this condition until prescribed fire is reintroduced (Table 9).

Alternatives attempt to shift these conditions closer to NRV through a number of varying proposed actions throughout the fire. All alternatives alter the proportion of high severity fire although all of them still exceed NRV. It is also important to note that all alternatives treat the low and moderate severity areas to different degrees. Recent research recommends that fire effects that result in moderate severity fire of similar proportion to low severity fire may be more effective for achieving ecological restoration objectives in fire excluded Sierra Nevada mixed conifer and yellow pine forests and low severity fire effects may be more beneficial to ecological objectives in active fire regimes (Meyer 2015). This emphasizes the importance of reducing treatment in the low and moderate severity areas or minimizing this treatment to maintain some proportion on the landscape that meets these criteria, especially since this area had been fire excluded (Figure 9). High severity patch sizes were well outside the range of variability. All alternatives change the distribution and continuity of these patches (Figure 7). The greater number of large (>150 acres) high severity patches on the landscape bring the landscape further from NRV, therefore Alternative 4 would get the closest to meeting NRV from a patch size perspective.

Prior to the fire, mixed conifer yellow pine forests were largely departed from the pre-European fire return interval. All alternatives propose to treat the landscape with prescribed fire in the next five years. The main objectives for these proposals are to break up continuity in early-seral habitat that will be largely dominated by shrubs and other herbaceous cover types. The main difference between the alternatives is the varying densities of trees that will be planted in the variable density areas. This post-treatment condition might affect the ability to prescribed burn in the future although little to no information is available on this type of treatment.

Maintaining multi-structure early-seral conditions is important across the King Fire area for: 1) supporting wildlife that require post-fire snags and shrubs, 2) breaking up the continuity of adjacent seral stages, and 3) allowing natural succession to proceed. All of the alternatives maintain multi-structure early-seral conditions that fall within NRV although Alternative 3 maintains the highest that still falls within the range of NRV.

Evaluating the NRV across the King Fire allows for the development and evaluation of treatments across this landscape. By understanding how the existing conditions differ from the NRV across the Sierra Nevada, we are better capable of shifting the landscape to a more resilient landscape.

Tables and Figures

Table 1. Literature and Data Sources Used to Estimate the Natural Range of Variation in Mixed Conifer Forests

Stand or Landscape Variable	Literature/Data Sources	Confidence
Proportion of fire severity classes	(Safford 2013, Meyer 2015)	Medium
High severity patch size	(Safford 2013)	Medium
Reference fire return intervals	(Van de Water and Safford 2011, Safford 2013)	High
Proportion of early-seral stage	(Safford 2013)	Medium

NRV reference information is based on a variety of sources which may include modeled estimates, stand reconstruction data, historic inventory data, and information from contemporary reference landscapes (e.g., landscapes with an active fire regime). “Confidence” refers to the level of certainty in the estimation of the NRV based on the number of studies evaluated, the depth and validity of information, and applicability to the landscape being compared to NRV.

Table 2. King Fire Severity (%) at Different Times During the Fire as Compared to NRV

Fire Severity	NRV	% Burned 17th of September	% Burned Outside of 17th of September	% Total Fire
Unchanged	10-30	**4**	21	12
Low	31-58	**12**	38	**25**
Moderate	15-35	**13**	20	16
High	5-11	**71**	**22**	**47**

*Bolded values are outside of NRV.

Table 3. Fire Severity Proportions in Each Severity Class by Alternative

Severity	NRV	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Unchanged	21 (10-30)	26	28	28	30	28
Low (0-25%)	43 (31-58)	14	16	15	15	16
Moderate (25-90%)	26 (15-35)	13	12	12	11	12
High (>90%)	9 (5-11)	47	44	44	43	44

Table 4. High Fire Severity Patch Metrics in the King Fire Alternatives

Alternative	Total High Severity Acres	Count Patches	Mean	Standard Deviation	Maximum	Largest Patch Area Percentage
King Fire[1]	39687	1446	27	505	17311	44
Alt 1	24233	1041	23	432	13661	56
Alt 2	12603	1123	11	81	2111	17
Alt 3	14562	1189	12	83	2111	14
Alt 4	12019	1090	11	80	2051	17
Alt 5	12603	1123	11	81	2111	17

[1] This includes all area that had some percentage of conifer dominance including areas that were conifer mixed hardwood and excludes the private inholdings.

Table 5. High Fire Severity Patch Sizes in the King Fire Alternatives[1]

Alternative	Patch Size				
	0 – 10 acres	10 -150 acres	150 – 500 acres	>500 acres	Total
King Fire	1555	3255	2679	32198	39687
Alt 1	1106	2856	3384	16887	24233
Alt 2	1253	3802	3179	4369	12603
Alt 3	1388	4757	3198	5219	14562
Alt 4	1240	3296	2924	4559	12019
Alt 5	1253	3802	3179	4369	12603

[1] This includes all area that had some percentage of conifer dominance including areas that were conifer mixed hardwood and excludes the private inholdings.

Table 6. Pre-European Fire Return Intervals (PFRI) from the Centuries Preceding Euroamerican Settlement for Yellow Pine and Mixed Conifer Forests in California

(Van de Water and Safford 2011)

Forest type	Mean	Median	Mean Min	Mean Max	Number of sources
Yellow pine	11	7	5	40	24
Dry mixed conifer	11	9	5	50	37
Moist mixed conifer	16	12	5	80	53

Table 7. Early-Seral Coniferous Conditions Classified by Level of Treatment (definitions provided in text) and Percentage of Conifer Dominated High Severity Fire in the King Fire

Seral Gradient	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Multi-structure early-seral conifer forest	61	32	37	30	32
Snag Retention Patches	-	3	4	5	3
Multi-structure early-seral conifer forest Total	61	35	41	35	35
Single-structure early-seral conifer forest	-	4	4	6	4
Variable density early-seral conifer forest	-	31	26	26	31
Total high severity (acres)	39,687	39,687	39,687	39,687	39,687

Table 8. Early-Seral Coniferous Conditions Classified by Multi-Structure Early-Seral Forest as a Percent of Total Fire Area

Early-seral Conditions	NRV	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Multi-structure early-seral forest total (acres)	-	24,238	13,839	16,300	13,739	13,839
Percent of Total Fire Area	15-20	25	14	17	14	14

Table 9. Summary of Current Ecological Conditions in the King Fire as Compared to NRV
(Conditions Are Noted As "Unknown" If Current Data Was Unavailable For Comparison)

Stand or Landscape Variable	Within NRV?	Direction of Departure	Alt(s) Bring Variable Closest to NRV	Figure/Table
Proportion of fire severity classes	No	Increased high severity fire	Alts 2, 5	Figure 2,3,4 Table 2,3
High severity patch size	No	Increase in large patches	Alt 4	Figure 4,5,6,7 Table 4,5
Reference fire return intervals	No	Longer FRI	Alt 3	Figure 8,9 Table 6
Proportion of early-seral stage	No	Increase in early-seral forests	Alts 2, 3, 5	Figure 10 Table 7,8

Figure 1. Preliminary Vegetation Severity Map (RAVG) Classified by the Composite Burn Index (CBI)

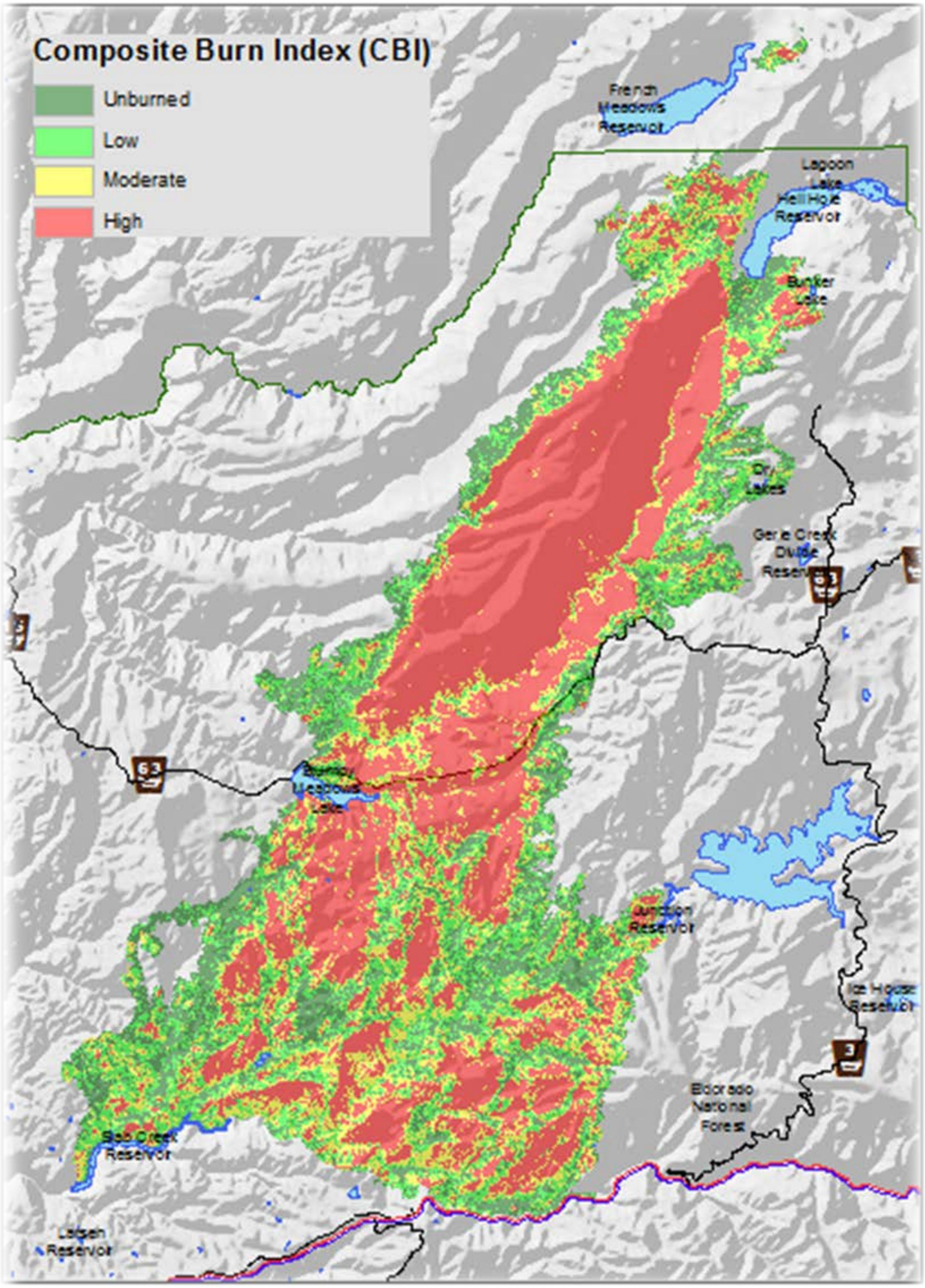


Figure 2. Mean (±SD) Fire Severity Proportions in Each Severity Class Based on NRV and Resource Objective Wildfires in the National Forests of the Southern Sierra Nevada
(Meyers 2014)

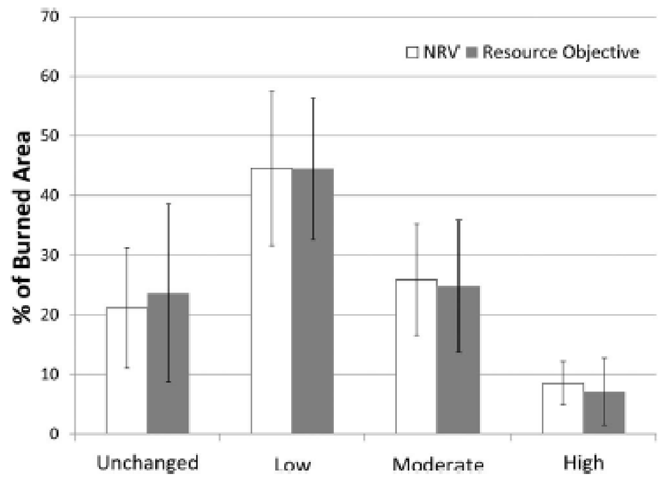


Figure 3. Vegetation fire severity was dependent on the dominant weather during the respective burn period.

Fire severity throughout the entire fire progression (a), fire severity on September 17 (b), and fire severity on all days excluding September 17 (c).

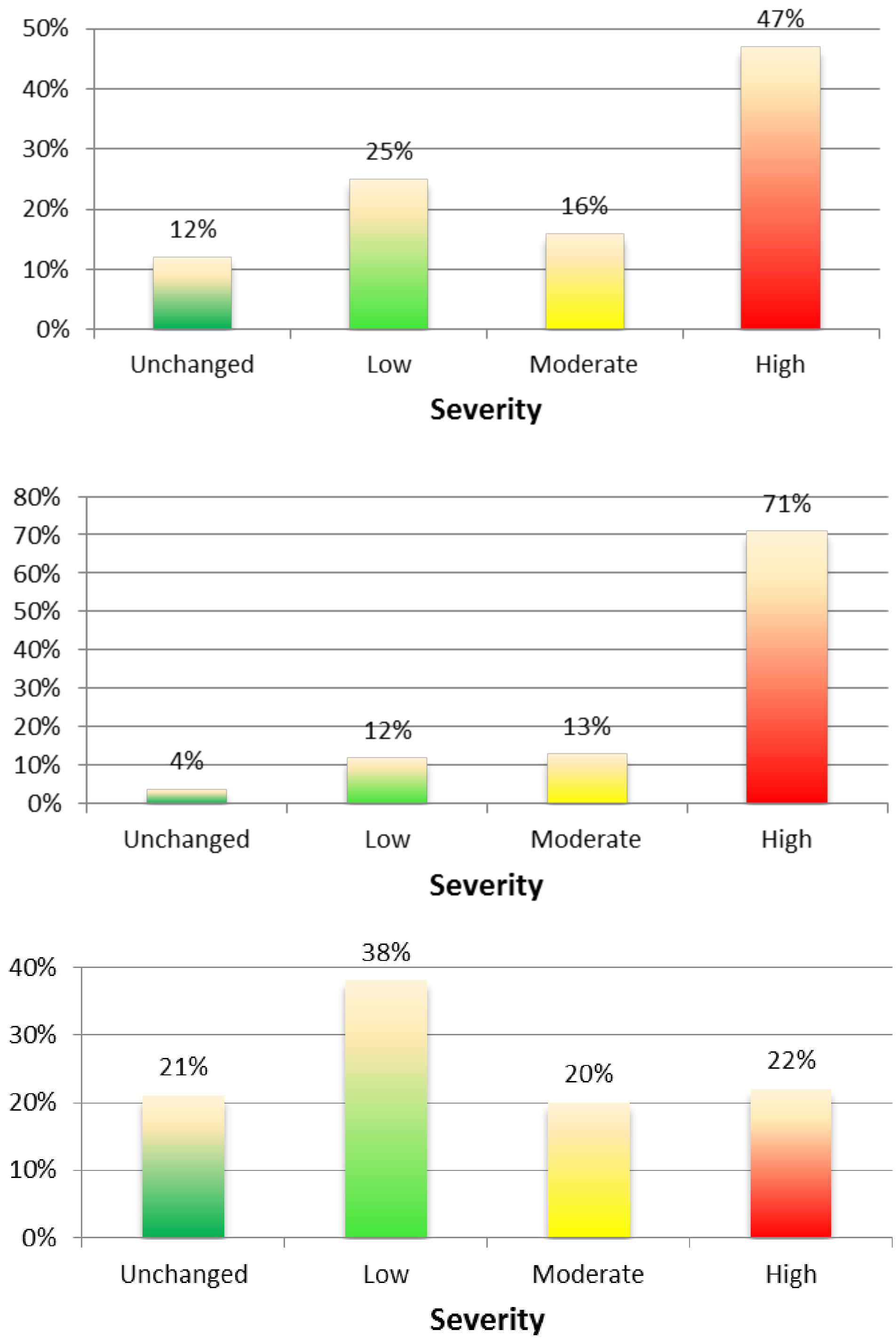


Figure 4. Histogram of High Severity Conifer Mixed Patches on the King Fire
Acres are on a logarithmic scale.

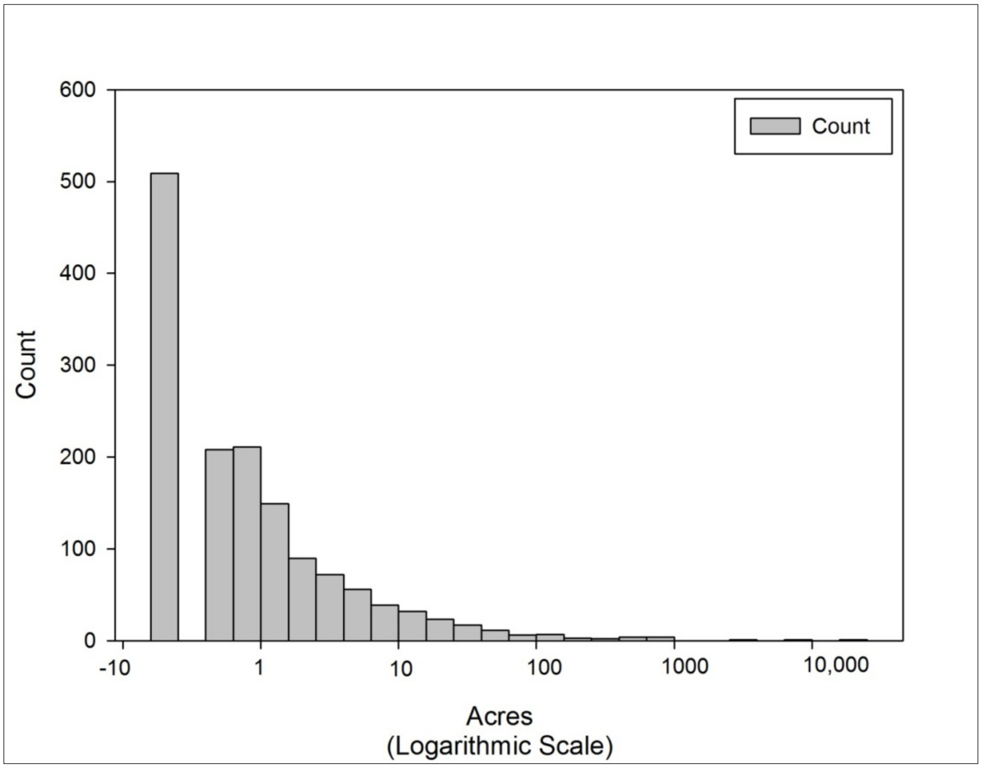


Figure 5. Examples of mixed and high severity in the King Fire.
The left panel burned on 9/16/2014 in moderate weather conditions. This resulted in patches of unburned or surface fire that had only isolated mortality in the canopy and patches of high severity with >90 percent mortality. The right panel burned on 9/17/2014 in extreme weather conditions leading to large patches of high severity with >90 percent mortality.

Figure 6. Canopy View of a High Fire Severity Patch (Upper) and a Moderate Severity Patch Within the King Fire

Figure 7. Conifer Dominated High Severity Patches in Four Size Classes (0-10, 10-150, 150-500, and >500 acres) in the Four Alternatives. Alternative 5 is similar to Alternative 2.

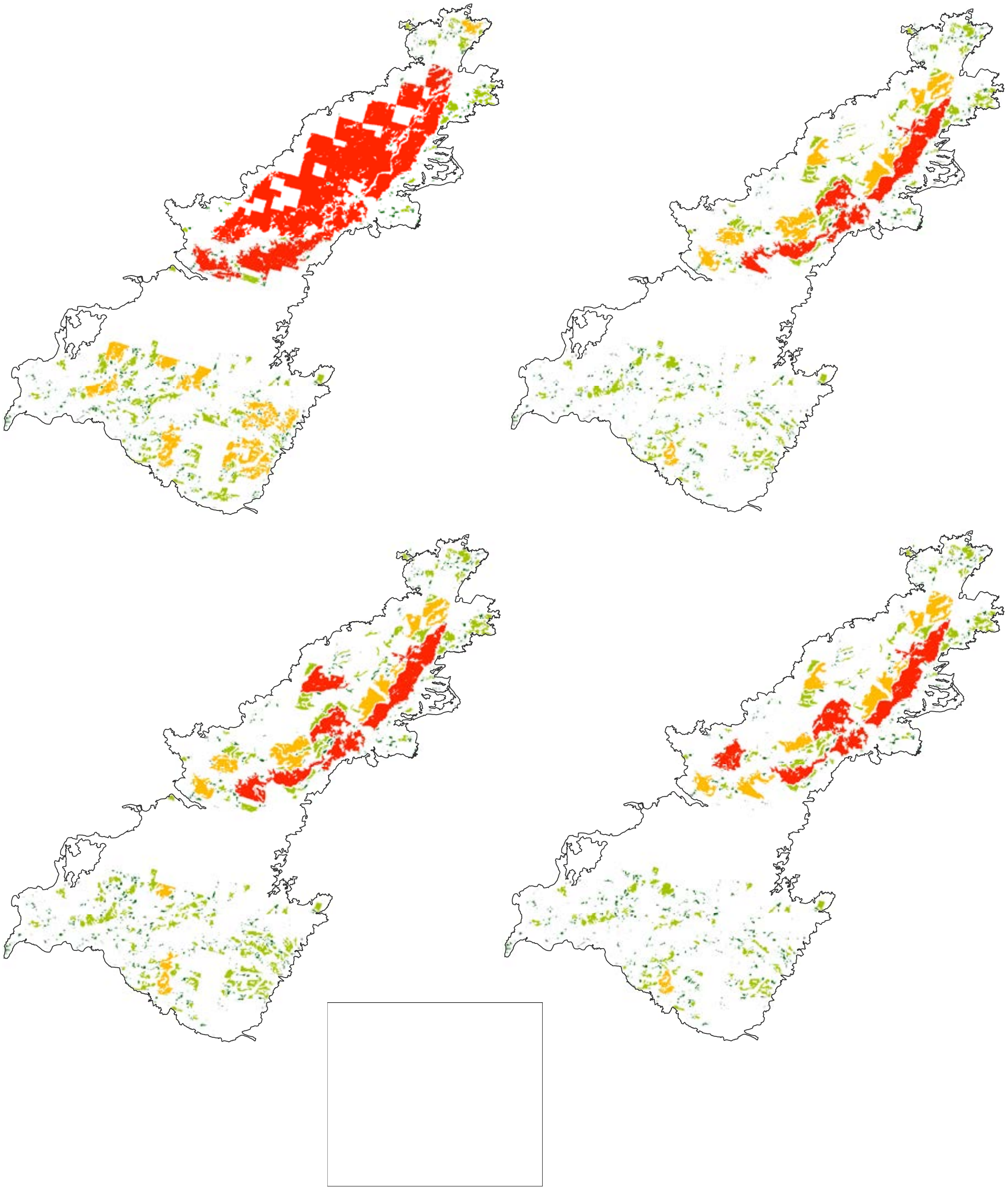


Figure 8. Fire History by Decade Within the King Fire Perimeter

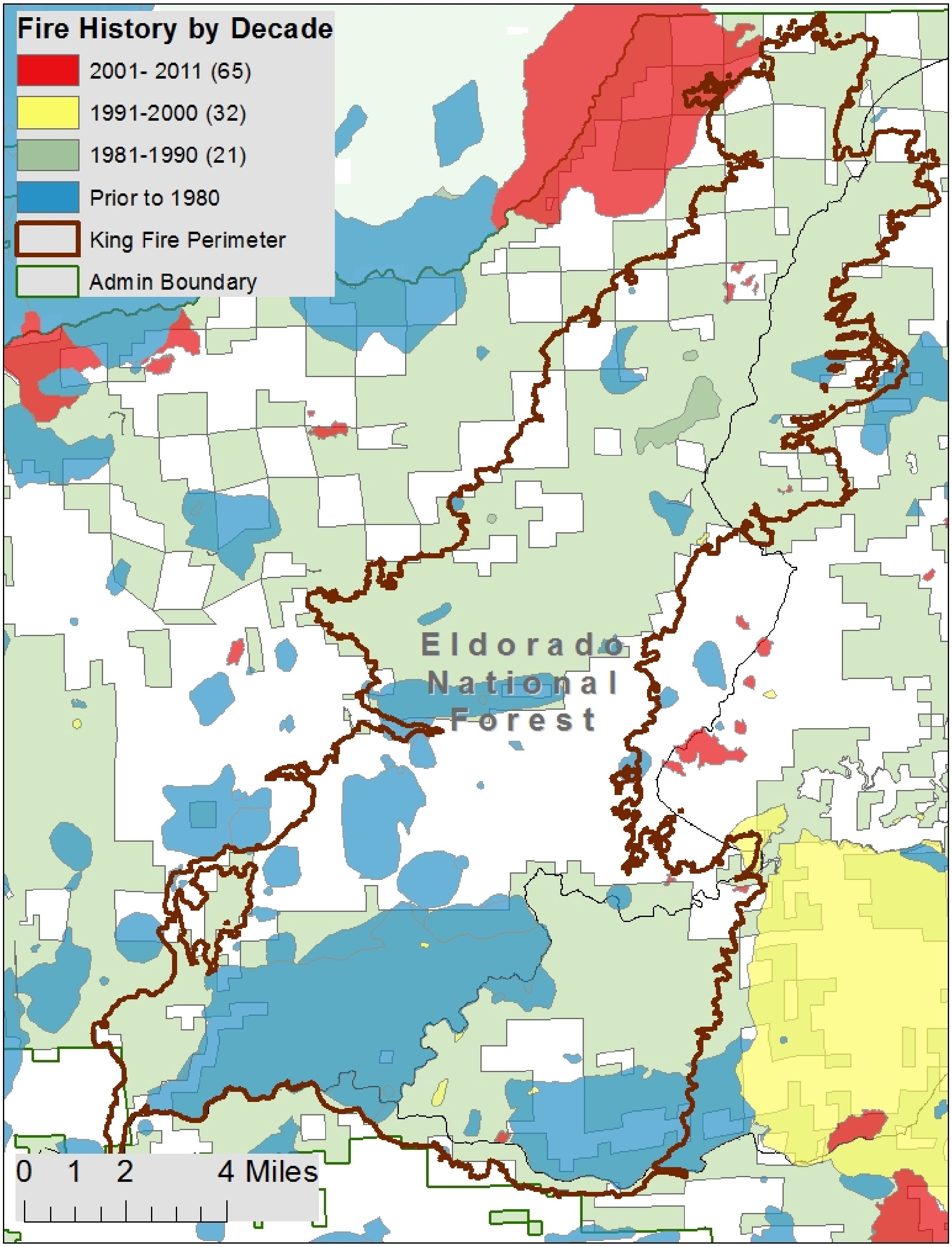


Figure 9. Mean Percent Fire Return Interval Departure in the King Fire

Warm colors are experiencing more fire than under pre-Euroamerican condition, cool colors are experiencing less fire.

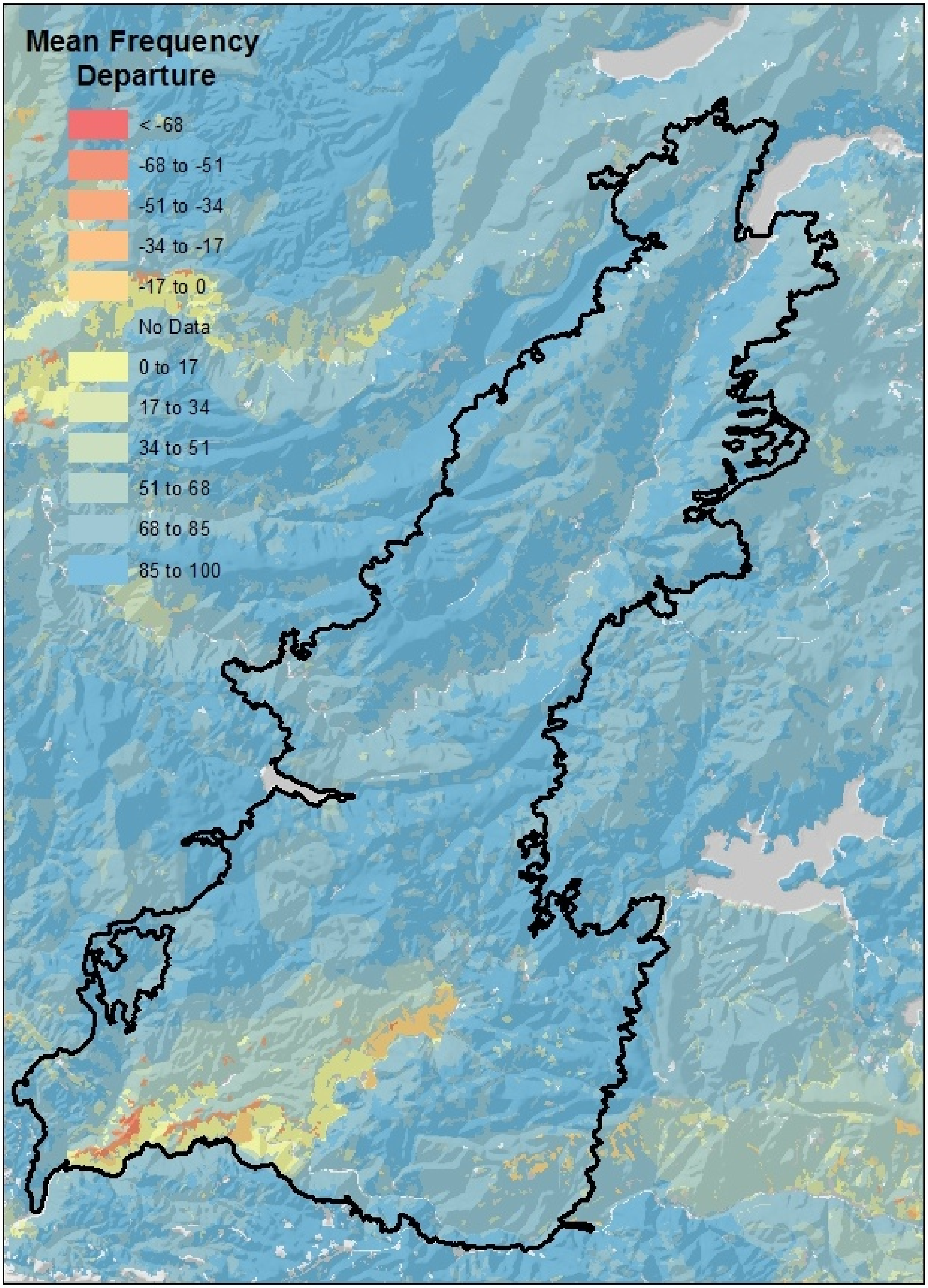


Figure 10. Average Landscape Conditions for Pre-Settlement YPMC Forests as Predicted by LANDFIRE BpS State and Transition Models for LANDFIRE Modeling Region 6
Only applicable on landscapes greater than about 5,000 hectares in area. See text for definitions of successional classes.

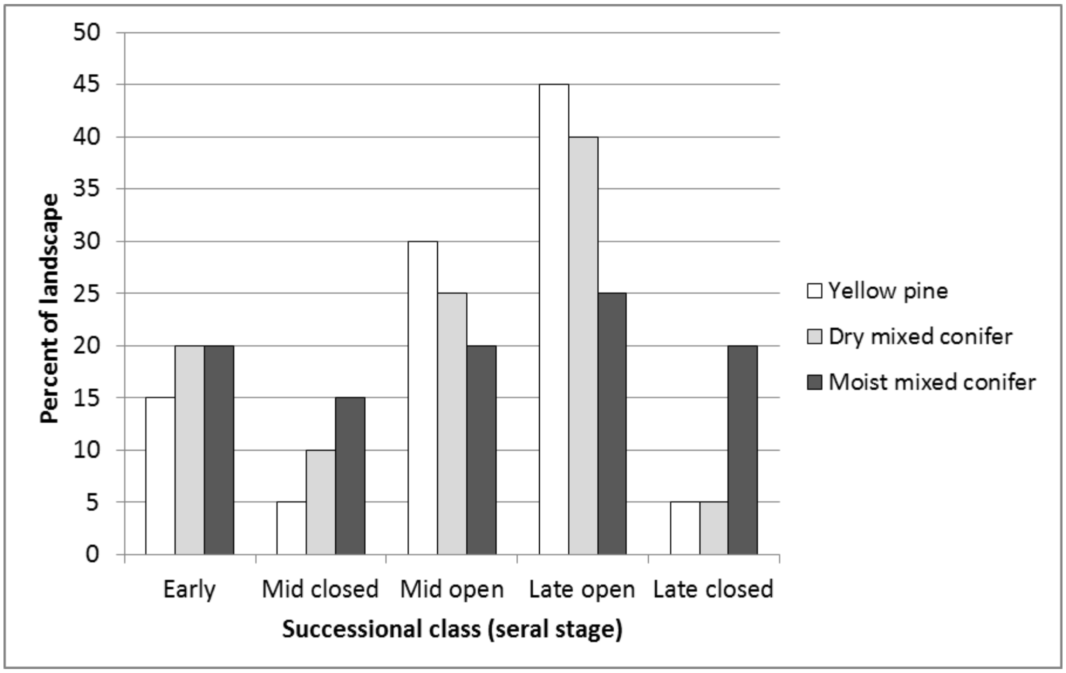
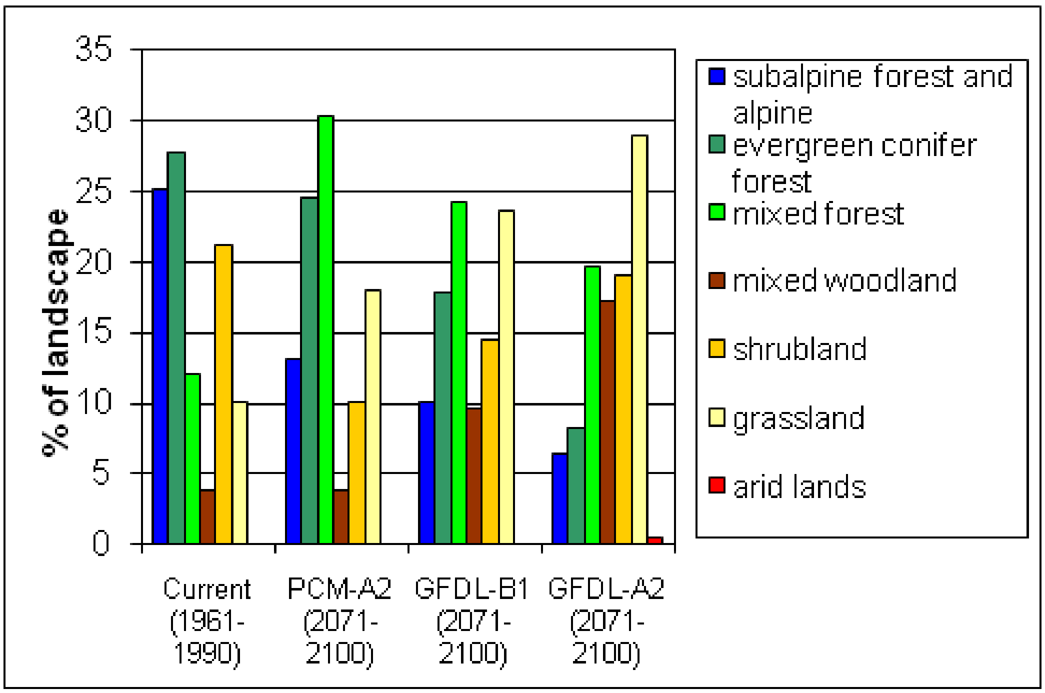


Figure 11. Lenihan et al. (2008) Modeling Results for the Sierra Nevada, Current vs. Future Projections Of Vegetation Extent

These Ecological Sections include most of the Sierra Nevada west slope. The GFDL-B1 scenario = moderately drier than today, with a moderate temperature increase (<5.5° F); PCM-A2 = similar ppt. to today, with <5.5° temp. increase; GFDL-A2 = much drier than today and much warmer (>7.2° higher). All scenarios project significant loss of subalpine and alpine vegetation. Most scenarios project lower cover of shrubland (including west side chaparral and east side sagebrush), due principally to increasing frequencies and extent of fire. Large increases in the hardwood component of forests are projected in all scenarios. Large increases in cover of grassland. Figure from Safford et al. (2012b).



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APPENDIX B

KING FIRE VEGETATION RESILIENCE AND RESTORATION ASSESSMENT

DANA WALSH, SILVICULTURIST, ELDORADO NATIONAL FOREST

BRIAN EBERT, FIRE MANAGEMENT SPECIALIST, VEGETATION MANAGEMENT SOLUTIONS

BECKY ESTES, CENTRAL SIERRA PROVINCE ECOLOGIST, ELDORADO NATIONAL FOREST

BACKGROUND

On Saturday, September 13, 2014, the King Fire began at approximately 3,000 feet elevation along Forebay Road near the town of Pollock Pines, California, on the State District Protection Authority. The fire quickly spread onto the Eldorado National Forest (ENF) into steep, rugged terrain (slopes of 100% and greater) through the South Fork of the American River drainage before burning through the Rubicon drainage covering a total of 97,717 acres (39,544 hectares) (Figure 1). The fire burned on the Placerville, Pacific, and Georgetown Districts of the ENF, El Dorado and Placer Counties, a small portion of the American River District on the Tahoe National Forest (TNF), as well as private lands. The King Fire perimeter totaled 97,717 acres, of which 63,536 acres is National Forest System lands managed by the Eldorado National Forest.

This report is designed to inform planning of recovery, reforestation, and restoration activities within the area. It is also intended to provide background on the long-term planning for restoring a resilient landscape. This document is meant to be used in concert with the “Fire Management Strategy within the King Fire” (Ebert et al. 2015) developed for the area, management objectives for other forest resources, and public participation to develop proposed actions and alternatives for National Environmental Policy Act (NEPA) decisions. This document is not meant to be a NEPA Proposed Action, but rather to inform future proposed actions.

The following analysis and information is based on historic conditions, conditions immediately prior to the fire, post-fire conditions, the current and past fire regime, environmental conditions, and long-term climate expectations for the area.

GIS DATA USED FOR ANALYSIS:

- S_R05_ENF.ExistingVegetation
- S_USA.BasicOwnership
- Ca3878212060420140913_20140903_20141005_ravg_data
- S_R05_ENF.Strata
- LMU (Landscape Management Unit) tool data for unsimplified slopes
- Wieslander Vegetation Composition Mapping
- Wieslander Vegetation Plot Level Data in the King Fire area
- Bioclimatic Envelope Modelling
- Kernal Density Probability Estimates of Future Seedfall

FOREST VEGETATION DESCRIPTION

HISTORIC VEGETATION

Historical ecology interprets previous landscape conditions such as vegetation composition and structure. It is of interest to land managers as it can provide a means to identify changes in forest conditions and ecosystem processes to help inform desired future conditions.

A wide range of data can be used to determine historical conditions from past efforts at vegetation mapping, reconstruction, and historical distributions of trees from the General Land Office surveys (GLO). To determine historical conditions in this project, the Wieslander Vegetation Type Map (VTM) project was utilized. This program was conducted from 1928 to 1940 by the US Forest Service in an effort to record the State of California vegetation (Wieslander 1935). Three efforts accomplished these goals: 1) photo documentation (Figure 1), 2) extensive tree/shrub plots, and 3) vegetation cover type mapping (Wieslander 1935).

FIGURE 1. *PINUS PONDEROSA, PINUS LAMBERTIANA* VIRGIN TIMBER NEAR MICHIGAN, CALIFORNIA, LOGGING CAMP. REPRODUCTION MOSTLY *ABIES CONCOLOR*., T 12 N R 13 E SEC 22, ELEVATION 4800 QUAD NAME: PLACERVILLE. QUAD NUMBER: 56

TABLE 1. WIESLANDER VEGETATION CLASSIFICATION BY WILDLIFE HABITAT RELATIONSHIP (WHR) LIFEFORM CLASS FOR ONLY THE AREA ON THE ELDORADO NATIONAL FOREST BURNED IN THE KING FIRE[1]

Vegetation Class	Acres
Conifer Forest / Woodland	47,681
Hardwood Forest / Woodland	11,505
Herbaceous	44
Barren	50
Shrub	3,309
Grand Total	**62,589**

[1]The difference in total acres reflects the coverage dissimilarities between the Wieslander maps and existing vegetation maps.

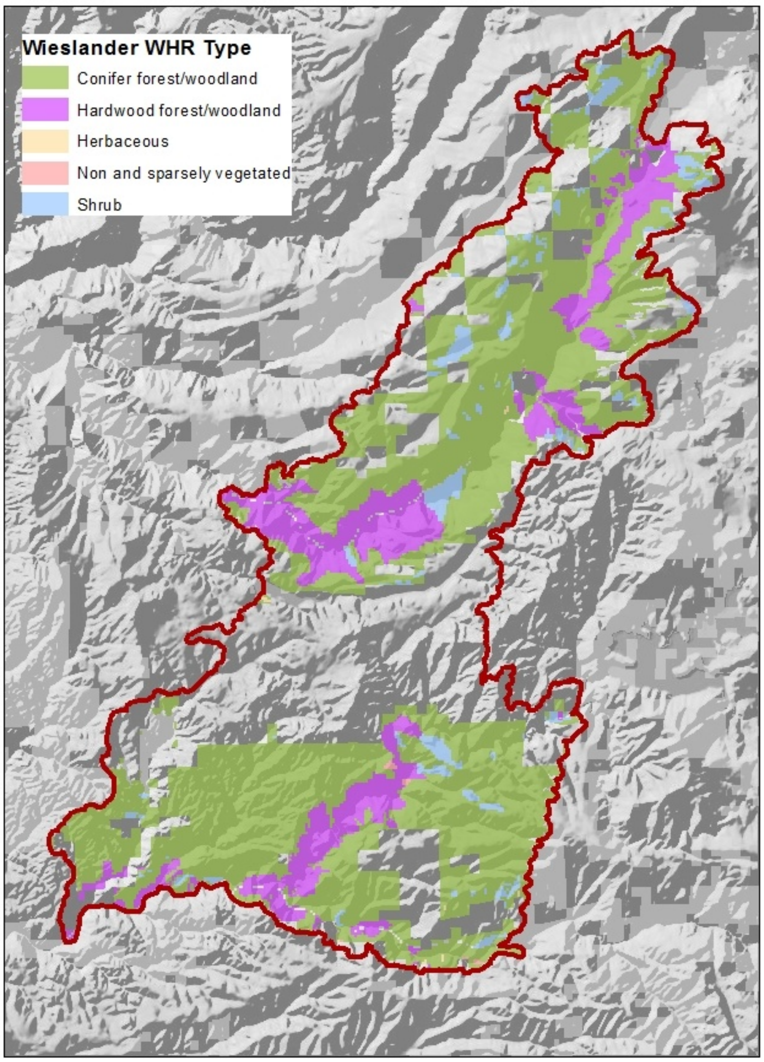

FIGURE 2. THE EXTENT OF WILDLIFE HABITAT RELATIONSHIP VEGETATION COVER TYPES IN THE KING FIRE TAKEN FROM THE WIESLANDER COMPOSITION MAPS.

PRE-FIRE VEGETATION

While the current (pre-fire) vegetation is important to assessing site capability and can inform future management objectives, it is important to recognize that the condition of the forest prior to the fire is not necessarily indicative of a desired condition. Forests in this area pre-European were historically subject to frequent, low to moderate intensity fires that resulted in open, fire-resistant stands of trees (Van Wagtendonk and Fites-Kaufman 2006). Multiple decades of fire exclusion, grazing by domestic livestock, mining, and historic logging practices, including selective logging of large pines and lack of follow-up slash treatment, have contributed to altered fire regimes, heavy fuel loadings, and changed vegetation composition and structure (McKelvey et al. 1996; Knapp et al. 2013; Safford 2013).

To various degrees the forest prior to the fire had been changed from one dominated by large, old, widely spaced trees to one with dense, fairly even-aged stands. Past timber harvest, infilling of trees into gaps that were historically created or maintained by fire and species composition shifts had resulted in a homogenization of the landscape (Knapp et al 2013). Compared to historic conditions stands had fewer old fire-resistant trees, such as ponderosa pine, more stands with multiple canopy layers and high stem densities, and a more densely forested landscape with continuous and high fuel levels (Collins et al. 2011). Consequently the landscape had been identified by the Eldorado National Forest to be more susceptible to stand-replacement wildfire, because it was highly departed from its pre-European fire return interval (Estes and Gross 2015).

Prior to the fire, the main land allocation based on the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) for the areas burned was Home Range Core Area (HRCA) for California spotted owl. The areas within the fire had been recognized as not meeting desired conditions for fire and fuels objectives, forest health, or stand resilience, and several fuels reduction and forest health projects had been planned to move vegetation in strategic areas from current conditions to a more resilient condition, while continuing to provide and advance habitat objectives associated with the HRCA land allocation. These projects included the Big Grizzly Forest Health and Fuels Reduction Project, the Blacksmith Ecological Restoration Project, the 2-Chaix Fuels Reduction and Forest Health Project, the Misfire Fuels Reduction Project, the Hartless Fuels Reduction Project, and the Hey Joe Fuels Reduction Project within recent years. While Misfire, Hey Joe, and Hartless had been recently completed, the other projects were still in the initial stages of implementation.

Other than some hazard removal and immediate burn area emergency response work, the majority of vegetation treatments including salvage and reforestation are likely to focus on the areas that were identified as conifer or mixed hardwood/conifer forest prior to the fire.

TABLE 2. VEGETATION CLASSIFICATION BY WILDLIFE HABITAT RELATIONSHIP LIFEFORM CLASS FOR ELDORADO NATIONAL FOREST BURNED IN THE KING FIRE

Vegetation Class	Acres
Conifer Forest / Woodland	44,106
Hardwood Forest / Woodland	11,619
Herbaceous	508
Mixed Conifer and Hardwood Forest/ Woodland	3,594
Non and Sparsely Vegetated	939
Shrub	2,649
Grand Total	**63,415**

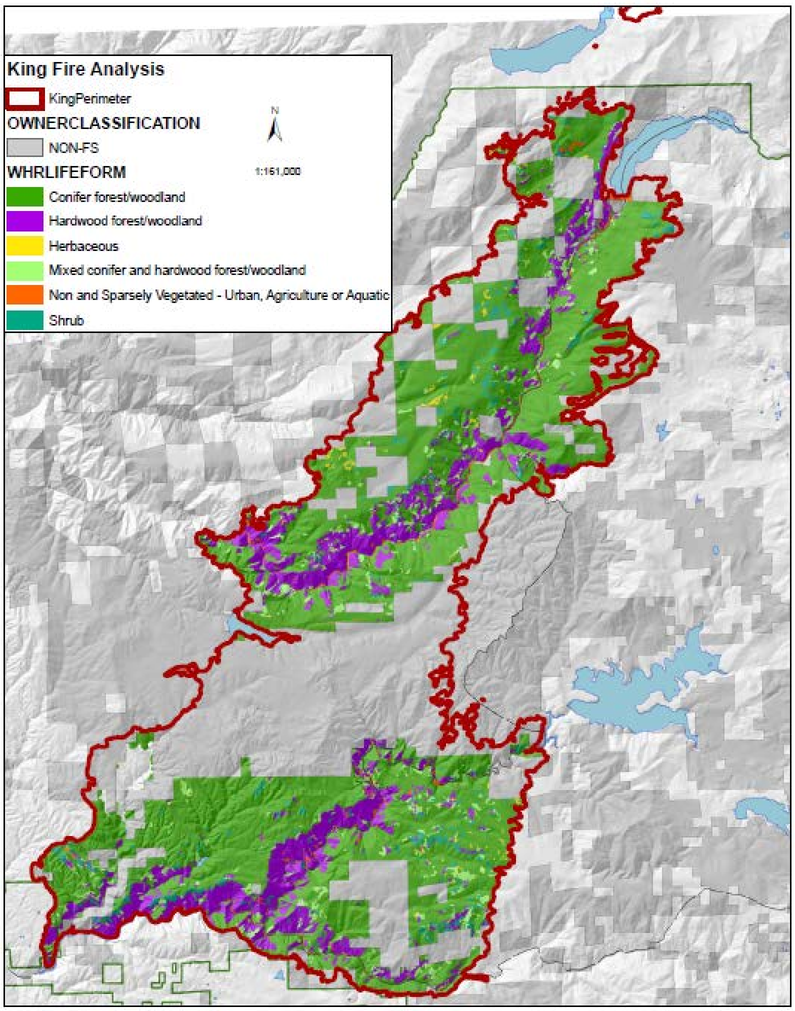

FIGURE 3. WHR LIFEFORM CLASSIFICATIONS FOR AREAS BURNINED WITHIN THE KING FIRE

TABLE 3. WHR VEGETATION TYPES FOR CONIFER AND MIXED CONIFER AND HARDWOOD FOREST/WOODLAND TYPES WITHIN THE AREAS OF THE ELDORADO NATIONAL FOREST BURNED BY THE KING FIRE.

Vegetation Class and Type	Acres
Conifer	**44,105**
Closed Cone Pine	116
Jeffrey Pine	1,048
Ponderosa Pine	6,594
Red Fir	59
Sierra Mixed Conifer	35,745
White Fir	543
Mixed Hardwood-Conifer	**3,594**
Blue Oak Foothill Pine	12
Mixed Hardwood-Conifer	3,582

For conifer forests, the most common CWHR size class was 4 and 5. This indicates that most conifer stands within the fire perimeter were considered to be comprised of mid-seral to late-seral stage forests prior to the fire. Impacts from the fire to the conifer forest are especially important because conifer forest types provide some of the most beneficial uses to a variety of wildlife as well as a source of resource and economic value to local communities. Conifer forest may take decades to develop from young, seral stands to mature forests characterized by larger diameters and higher canopy cover.

HISTORIC VEGETATION COMPARISON TO PRE-FIRE VEGETATION

Thorne et al. (2008) compared Forest Service vegetation maps from the 1930s (VTM project; Wieslander 1935) with modern Forest Service vegetation maps in the Central Sierra Nevada. They found that the extent of montane hardwood, Douglas fir, and annual grassland had increased while low elevation hardwoods, montane chaparral, and upper elevation conifers had declined over the 60-year period. Thorne et al. (2008) noted that some of the chaparral areas had potentially transitioned to hardwood stands, but others were large patches of chaparral from earlier timber harvest and fires that had transitioned to conifer forest after the institution of fire suppression. Additionally, Thorne et al. (2008) reported a shift of the Sierra Nevada pine belt upslope as a result of intensive forest management and a changing climate. Most of this area was replaced with lower elevation shrubs and tree species (Weeks et al. 1934).

The Wieslander Vegetation Composition Mapping, when compared with the pre-fire vegetation map, identified the following trends specific to the King Fire (Table 4):

- No significant changes in areas dominated by conifers or hardwoods were noted within the King fire perimeter;
- Areas dominated by chaparral had decreased in the King fire perimeter since the Wieslander surveys were completed;
- Some areas dominated by hardwood and chaparral at the time of the Wieslander surveys had been replaced with an increased density of conifers; and

- Non and sparsely vegetated areas and herbaceous areas have increased since the time of the Wieslander surveys

TABLE 4. COMPARISON OF WIESLANDER TO PRE-FIRE VEGETATION CLASSIFICATION BY WILDLIFE HABITAT RELATIONSHIP LIFEFORM CLASS FOR ELDORADO NATIONAL FOREST BURNED IN THE KING FIRE. PERCENT AREA WITHIN THE KING FIRE THAT THE WHR TYPE COVERS.

Vegetation Class	Wieslander Vegetation %	Pre-Fire Vegetation %	Relative Change %
Conifer Forest / Woodland	76.18	75.22	-1.26
Hardwood Forest / Woodland	18.38	18.32	-0.33
Herbaceous	0.07	0.80	+91.25
Non and Sparsely Vegetated	0.08	1.48	+94.59
Shrub	5.29	4.18	-20.98

CHANGES IN VEGETATION RESULTING FROM THE FIRE

Areas in the King Fire that burned at lower severities are likely to maintain their structure and function into the future, while areas that burned at high severity will shift to an early-seral state. This shift is expected to be most pronounced in the areas that were identified as conifer forest and mixed hardwood/conifer forest prior to the fire.

TABLE 5. AREAS OF CONIFER AND MIXED CONIFER HARDWOOD FOREST WHERE BURNING WAS IDENTIFIED TO HAVE RESULTED IN BASAL AREA LOSS GREATER THAN 50 PERCENT ON NATIONAL FOREST SYSTEM LANDS WITHIN THE ELDORADO NATIONAL FOREST.

Vegetation Form and Class	>90% Mortality	75% to <90% Mortality	50% to <75% Mortality	Grand Total
Conifer Forest	**19,485**	**1,161**	**1,760**	**22,407**
Closed Cone Pine	40	6	11	57
Jeffrey Pine	593	10	17	621
Ponderosa Pine	2,433	208	335	2,977
Red Fir	20	3	3	26
Sierra Mixed Conifer	16,211	917	1,371	18,500
White Fir	187	17	22	227
Mixed Hardwood-Conifer	**1,914**	**126**	**175**	**2,216**
Blue Oak / Foothill Pine	0	0	2	3
Mixed Hardwood- Conifer	1,914	126	1,73	2,213

High severity patch sizes within the yellow pine mixed conifer forests were historically small (less than 10 acres) in size with some large patches greater than 150 acres in size covering about half of the total fire area (Sudworth 1900; Show and Kotok 1924). In low and middle elevation forests, high severity patch size has risen, with a dominance of small, scattered patches in pre-settlement and reference estimates, versus more contiguous, coarser-grained patchiness in modern fire-suppressed forests (Safford 2013). Recently, high severity patches >1,000 acres have become a regular occurrence with some areas doubling the area of high severity fire (Miller et al. 2012). In current reference sites such as the Sierra San Pedro Mártir and Yosemite National Park, high severity patches were <40 acres and <10 acres in size, respectively (Minnich et al. 2000; Collins and Stephens 2010). Additionally, Collins and Stephens (2010) analyzed fire severity patchiness in a watershed of Yosemite National Park and found that 48 percent of the total high severity area was in patches >150 acres, which only comprised about five percent of the total number of patches.

High severity conifer patches in the King Fire matched patch sizes seen in other fires that have occurred recently in the Sierra Nevada (Miller et al. 2012). The high severity patches covered 35,313 acres on both FS and non-FS lands. There were 279 patches within this area of which the area weighted mean was 6,358 acres (Figure 4). The landscape was more heavily weighted to the large patches which composed about 34 percent of the high severity area (Figure 5).

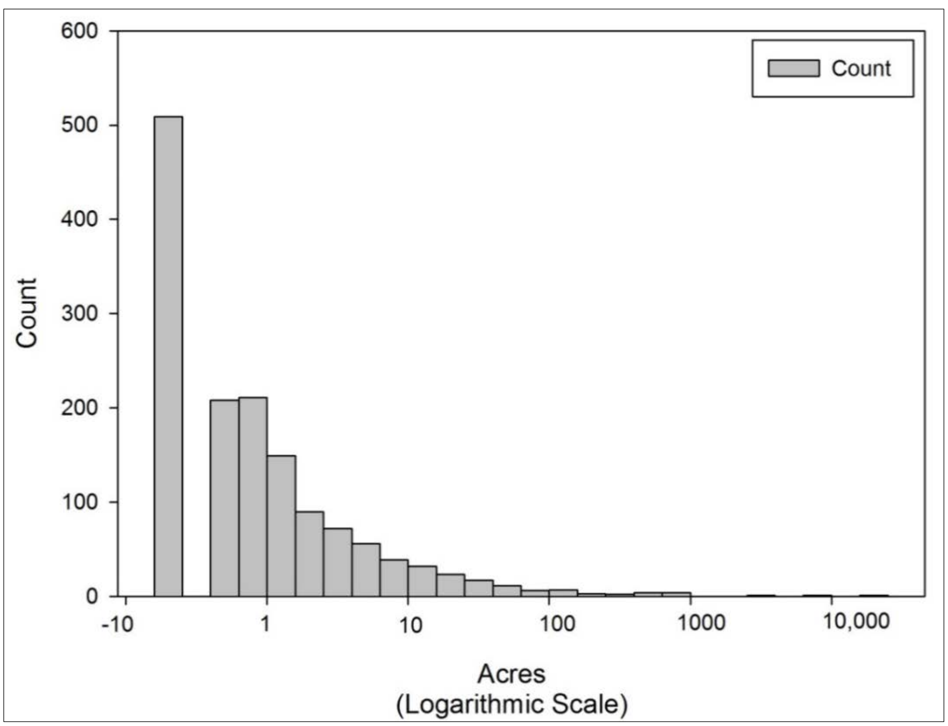

FIGURE 4. HISTOGRAM OF HIGH SEVERITY CONIFER MIXED PATCHES ON THE KING FIRE. ACRES ARE ON A LOGARITHMIC SCALE.

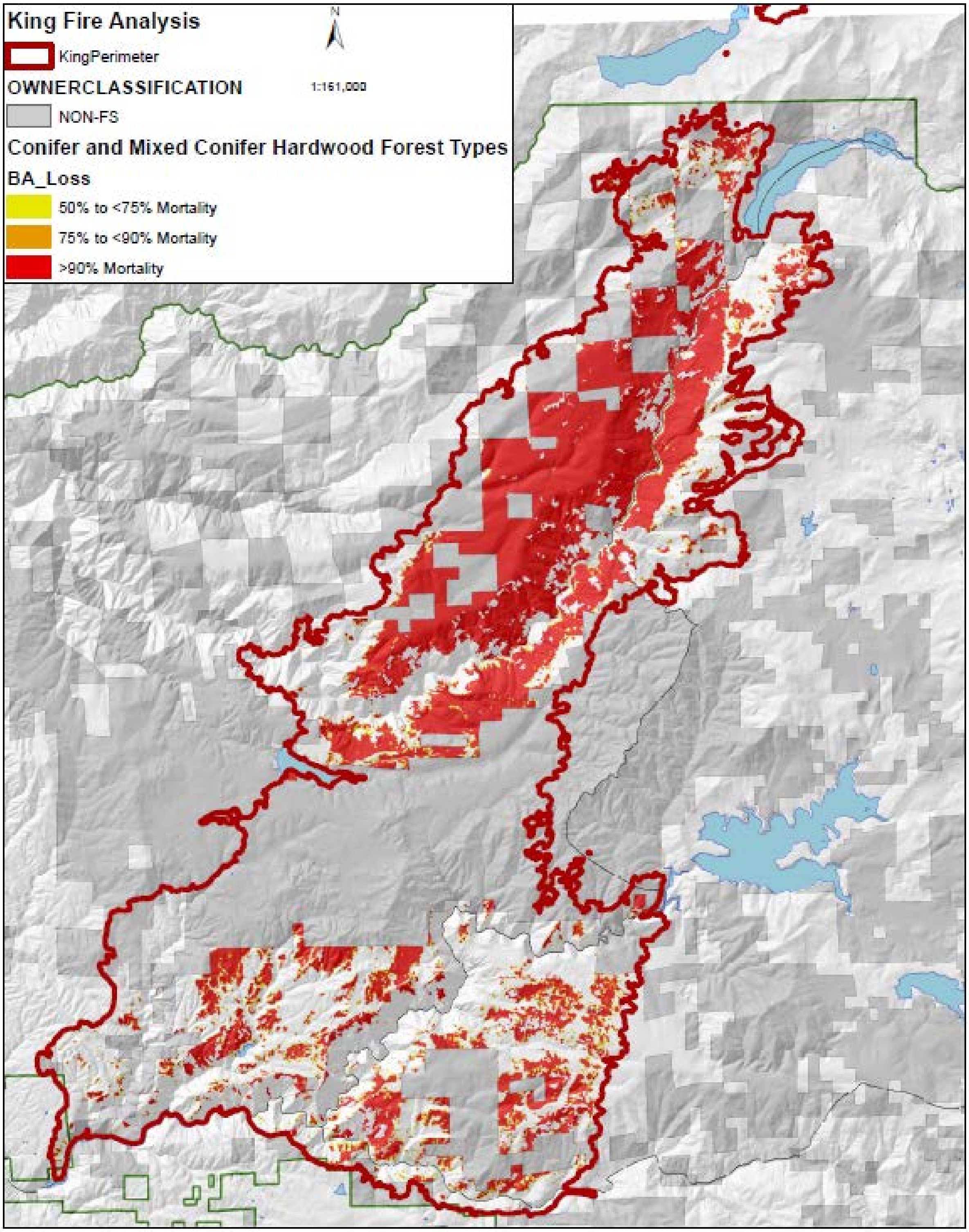

FIGURE 5. CONIFER AND MIXED CONIFER HARDWOOD FOREST TYPES WHERE BURN SEVERITY WAS IDENTIFIED AS RESULTING IN GREATER THAN 50% BASAL AREA LOSS

FUTURE CLIMATE INFORMATION

Few models have been completed that estimate the effects of climate on conifer dominated forests. Most suggest increased transition of forest to chaparral and increased transition of chaparral to grassland driven by increased fire activity (Lenihan et al. 2008). Paleoecological data from earlier warm periods (Pleistocene) that act as a corollary to our current predicted shifts in climate suggest an increase in early-seral vegetation and a decrease in the long-term persistence of late-seral forest in much of the western United States (McKenzie 2004, Cole 2010). Based on projections and current trends in southern California, it seems likely that some proportion of the yellow pine/mixed conifer forest belt will transition to shrubland and grassland over the next century (Safford 2013).

To quantify exposure to change, the degree to which a particular location, in a particular time window, was marginal, or outside, the current bioclimatic envelope was determined. This was then assessed for climatic projections for three time periods: 2010-2040, 2041-2060; 2061-2080. Each particular location was then characterized as at risk of change by assessing whether it falls outside the 99th percentile of the climate space for current representatives of that type. If a location is projected to be highly exposed by the end of the century, we mean that the climate of that location, using the 'best case' or 'worst case' model, is projected to fall outside the climatic attributes that describe 99 percent of current locations for that forest type. This assessment provides information on what areas may not persist as a particular vegetation type, but does not predict community shifts or the capacity of the current vegetation to adapt to climatic changes (Schwartz, personal communication).

Future projections (2041-2060) of climate exposure in the King Fire area based on the PCM model (warmer and similar precipitation) show that some areas may be moderately sensitive to future climate change. Levels of climate exposure indicate bioclimatic areas that are projected to be: 1) inside the 66th percentile (Dark Green), 2) in the marginal 67-90th percentile (Light Green), 3) in the highly marginal 90-99th percentile (Yellow/Orange), or 4) outside the extreme 99th percentile (Red) for the current bioclimatic distribution. Areas in green are suggestive of climate refugia.

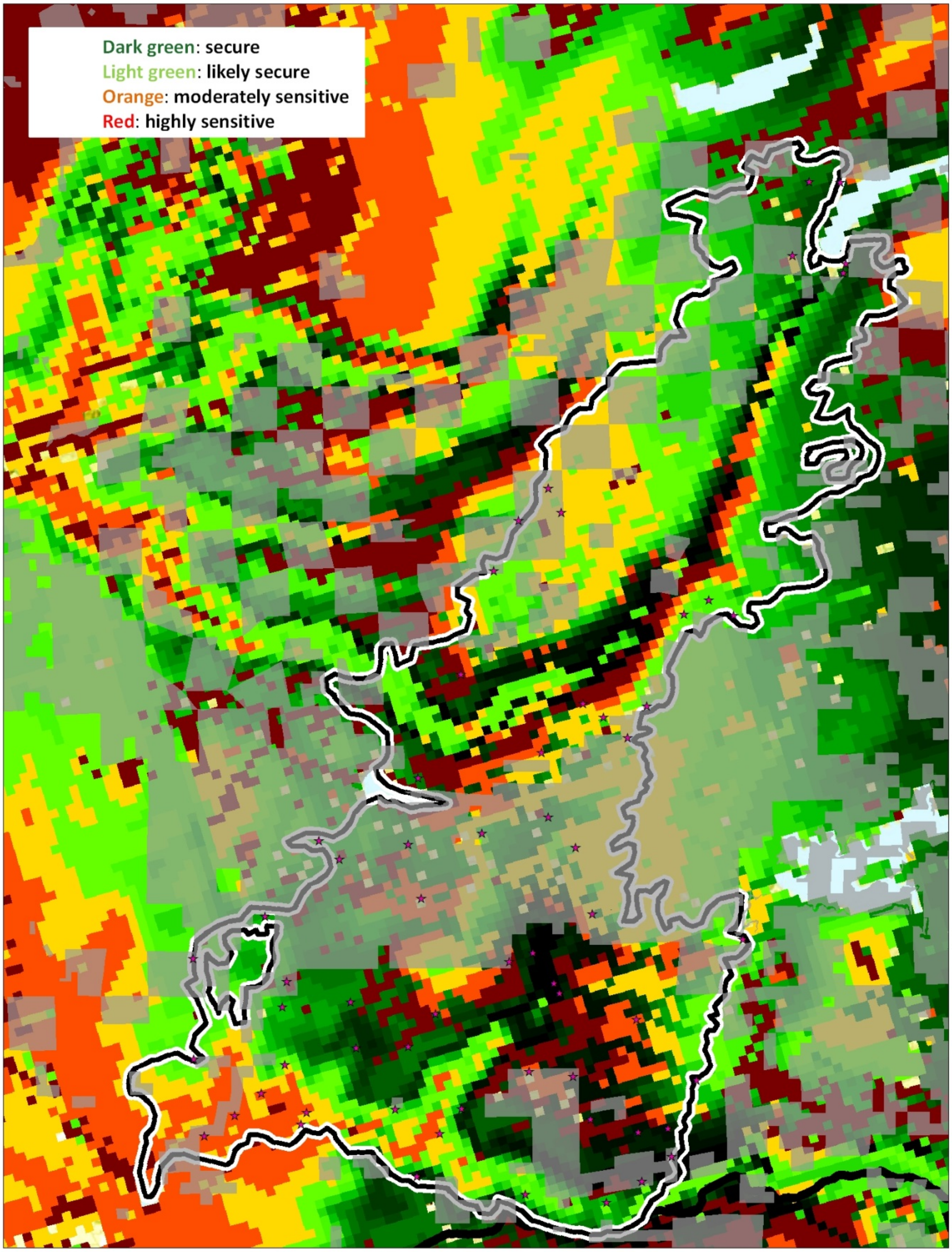

Figure 6. Bioclimatic envelope modelling in the King Fire Area (Schwartz, personal communication)

LANDSCAPE POSITION

Topography (e.g., elevation, slope, aspect, complexity) influences biophysical gradients such as solar radiation and topographic moisture (Holden et al. 2009). Studies have also found relationships between topography and fire severity (Weatherspoon and Skinner 1995; Collins et al. 2007; Thompson and Spies 2009). Fire regimes dominated by stand-replacing (high severity) fire regimes are not heavily influenced by microtopological variations (Turner et al. 1999). Likewise, forests that are significantly departed from historical fire return intervals may burn more homogeneously due to increased fuel loading (Miller et al. 2008). This is particularly true under extreme weather conditions that tend to negate the influence of topography on the landscape (Bradstock et al. 2010).

Topography is also a strong driver of environmental conditions. The density and structure of stands are dependent on landscape position, aspect, site quality, and available soil moisture. Likewise, these environmental conditions predict forest species composition, but are also an indication of past fire severity (Underwood et al. 2010; Lyderson and North 2012).

These differences in topography are evident across the King Fire landscape with varying aspect, elevation, and slope percent which all lead to variable environmental conditions (Figure 7). Twenty-one percent of the King Fire is found on ridges (Table 6, Figure 7). Approximately 23 percent of the King Fire was found in canyons and lower slopes. The remaining area was found at midslopes of which 36 percent were located on southwest facing aspects. Slope percent ranged from 15-47%. All topographic locations had a similar wetness index although differences are likely more fine scaled than what was predicted.

TABLE 6: ASPECT, ELEVATION, SLOPE PERCENT, AND WETNESS INDEX BY TOPOGRAPHIC LOCATION IN THE KING FIRE.

Topographic Location	Percent of Landscape	Aspect	Elevation	Slope Percent	Wetness Index
Ridges	21	199 ± 100	4487 ± 932	35 ± 22	9 ± 1
Canyon/Lower Slope	23	200 ± 100	3877 ± 958	43 ± 25	10 ± 2
Mid slope NE < 30%	11	158 ± 134	4716 ± 551	17 ± 9	10 ± 2
Mid slope NE > 30%	9	175 ± 134	4448 ± 823	47 ± 17	9 ± 1
Mid slope SW < 30%	25	223 ± 60	4654 ± 646	15 ± 9	10 ± 2
Mid slope SW > 30%	11	202± 58	4349 ± 922	45 ± 15	9 ± 1

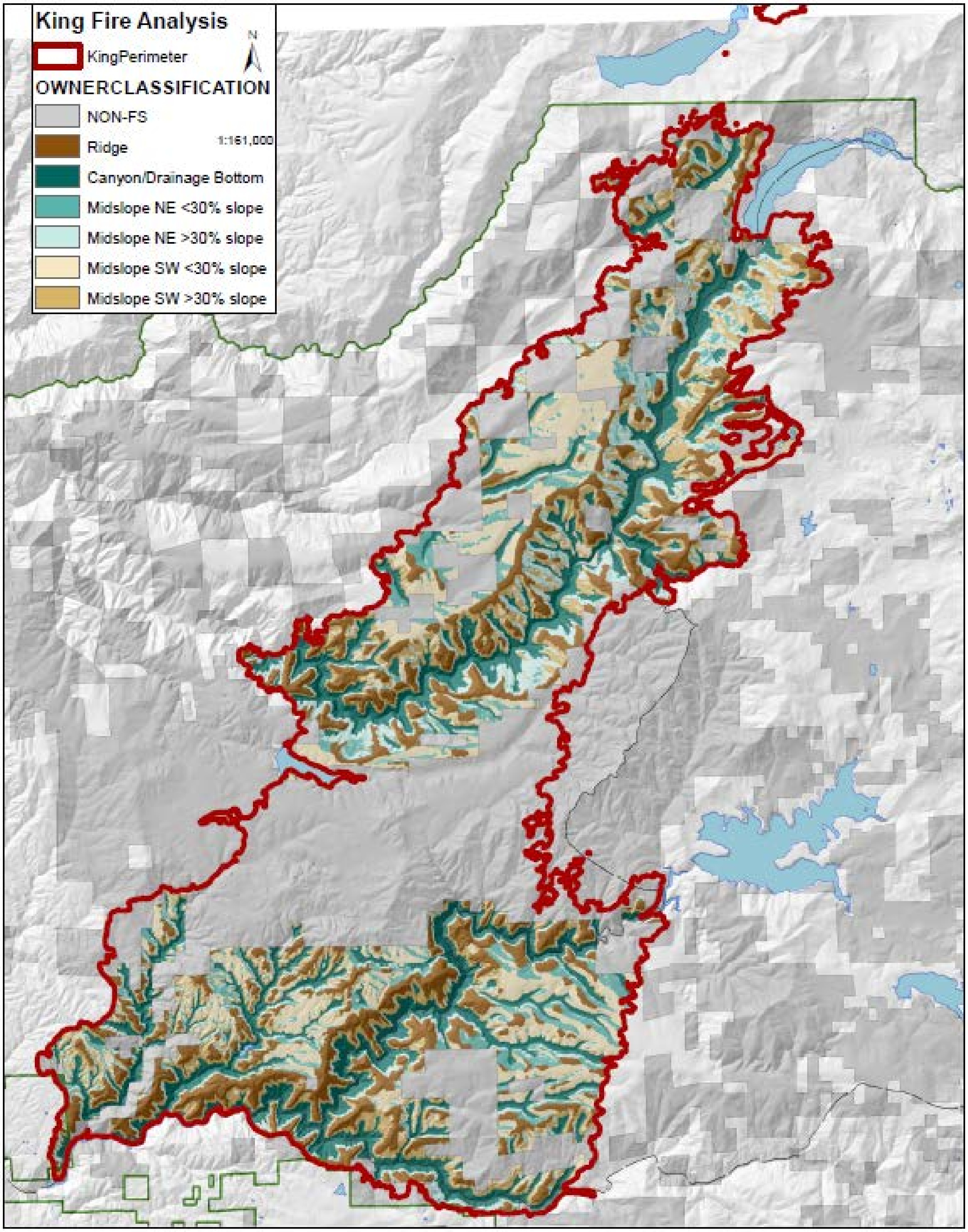

FIGURE 7. LANDSCAPE POSTION ANALYSIS USING UNSIMPLIFIED SLOPES FOR THE KING FIRE AREA

FOREST REGENERATION

The ability of forests to regenerate after stand-replacing fire is highly dependent on seed sources. Larger patches can create openings larger than available seed from neighboring surviving conifers can reach (Bonnet et al. 2005). Areas that have experienced high severity fire have been shown to have dramatically lower regeneration rates for conifers and especially for pines compared to areas burned at moderate or low severity (Crotteau et al. 2012). Crotteau et al. (2013) did not sample distance to seed source, but concluded that because seed trees were rare in their observation of high severity fire patches, this was a factor in their finding that fire severity impacted regeneration.

Although post-fire seedling establishment is driven by a series of factors (e.g., available moisture, soil insolation, rodent herbivory, damping-off fungi), the foremost requirement for most natural conifer regeneration is a seed source (Bonnet et al. 2005). It is likely that conifer regeneration densities in the low and moderate severity burns would be highest due to nearby remnant mature, seed-bearing trees. In addition to seed production, the remnant overstory in low and moderate severity burns produce high shade, a factor which may limit shrub competition, further permitting high densities of seedlings to establish. Uncharacteristically large high severity patches, on the other hand, have such poor overstory survival that distance to seed source becomes a limiting factor (Bonnet et al. 2005). High-severity burns may be less likely to naturally reforest if the scale is sufficient to preclude seed-tree adjacency (Bohlman and Safford 2014). While some studies have not been able to associate tree regeneration patterns in stand replacing patches with patch characteristics (size, perimeter-to-area ratio, or distance to edge) seedling regeneration and especially pine regeneration are reduced in patches of high severity fire (Collins and Roller 2013). Based on the current scientific information and previous experience it is expected and this analysis assumes that while some regeneration is likely to occur in portions of the areas of the King Fire where the fire resulted in substantial loss of vegetative cover due to moderate to high soil burn severity, regeneration of conifers and especially of pine in the area classified as high severity will be limited compared to other areas of the fire that burned at lower intensity.

Some areas may induce a reversion from forests back to shrubfields that were present under a more naturally occurring fire regime that existed under previous climatic condition (Nagel and Taylor 2005; Beaty and Taylor 2008). Severe fire may also induce type conversions that may not have occurred had the forest been in a more resilient condition (Long et al. 2014). The percent of grasses, forbs, and shrubs that establish within the King Fire is expected to increase in the areas that burned at higher fire severity. In areas where shrub development is rapid, shade tolerant trees and shrubs will likely be the dominant vegetation types into the future. Tall shrubs tend to create a competitive environment that favors shade tolerant conifer species, such as white fir and incense cedar. These species can persist in a shrub understory until eventually overtopping the shrubs. Shade intolerant species, such as ponderosa pine, and partially shade intolerant species, such as sugar pine, are also capable of seeding into sites at the stand initiation phase but competition with shrubs can create an unfavorable environment (Gray et al. 2005; Plamboeck et al. 2008). Outside of some strategic fuel treatments, post-fire salvage and restoration activities on National Forest System lands are most likely to occur within the high severity fire conifer and mixed conifer/hardwood forest with slopes less than 35 percent. This area totals approximately 16,000 acres. These areas present the best opportunity to restore forest conditions within the fire area and provide a seed source for future natural regeneration.

In order to determine approximate distance from nearest seed source, current literature states that dispersal is generally thought to occur within one to two tree heights, or ~200 feet and long-range distance dispersal has been documented at over 1,300 feet. To take a conservative approach, a 328-feet kernel density estimate was completed. Kernels were generated using unburned, low and moderate severity as proxies for seed sources, which were weighted as 3, 2, 1 to reflect theoretically more seed sources in the unburned, low, moderate categories.

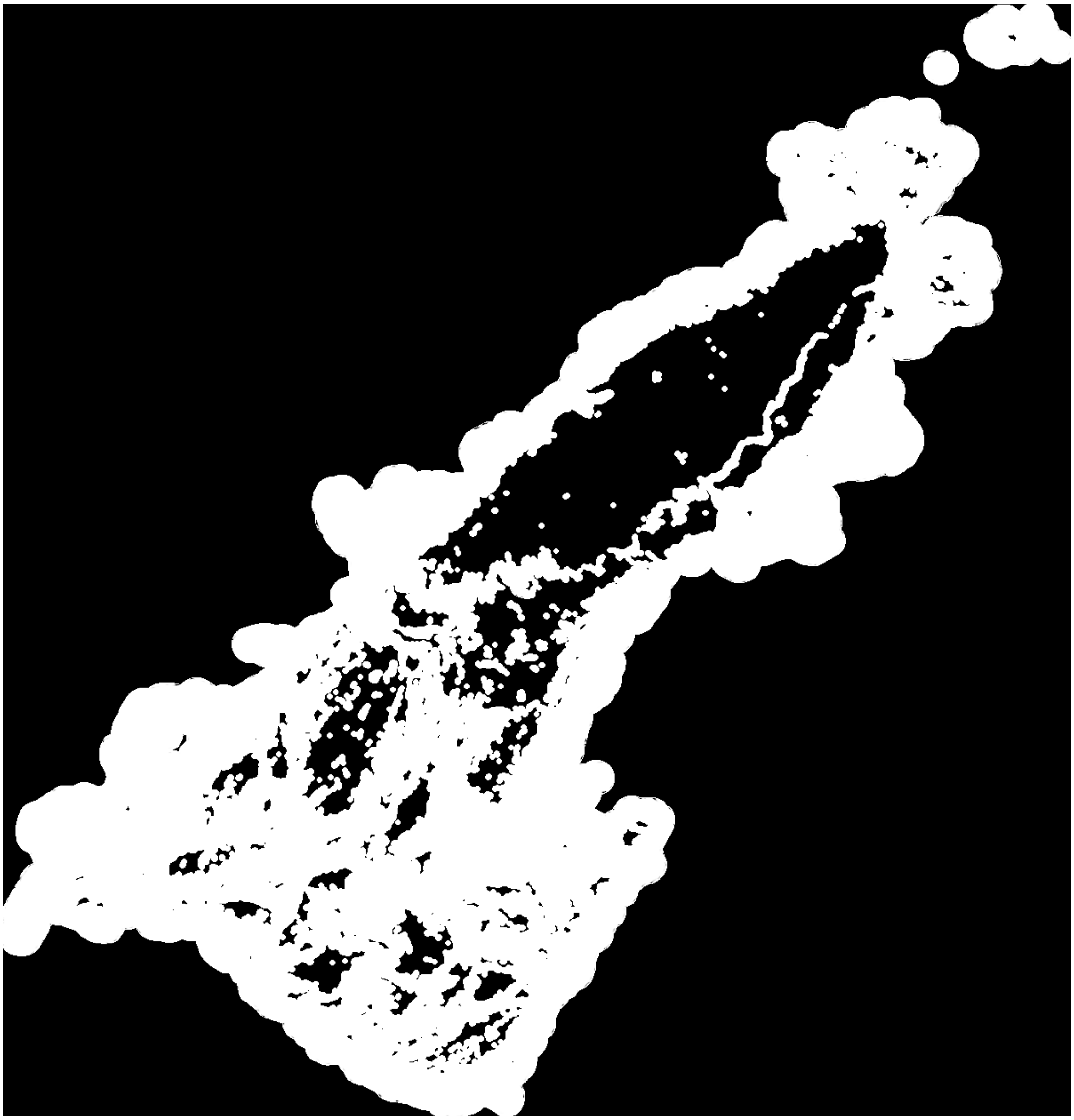

FIGURE 8. HIGHEST PROBABLE AREAS OF NATURAL REGENERATION AREAS (WHITE) IN THE KING FIRE AREA

SITE CLASS

Site class is important in both the forest structure an area can be estimated to support and in the timeline for developing forest structure. Higher sites are typically capable of producing and sustaining more complex forest structure than lower site conditions. While site class is defined in terms of timber volume growth, stand development is also an important factor for other forest resources.

REGION 5 (R5) SITE CLASS

R5 Site Class is based on Dunning's Site Classification. Site classes are represented by height and age as shown below. These are based on ponderosa pine, Jeffrey pine, sugar pine, Douglas fir, red fir, and white fir. Age is in years. Total height is in feet of average dominant and predominant trees with tree age of at least 50 years.

Site Classes for Region 5 were adapted from Dunning's site index curves for height at 300 years. Bulletin #28 Forest Research Notes 12/1/42 rerun 11/58. (http://www.fs.usda.gov/detailfull/r5/landmanagement/gis/?cid=fsbdev3_048098&width=full)

TABLE 7. HEIGHT BY AGE AND SITE CLASS CODE

Age	Site 0	Site 1	Site 2	Site 3	Site 4	Site 5
40	95	81	66	49	43	35
50	106	90	75	56	49	39
60	115	98	82	63	53	43
70	122	105	88	68	58	45
80	129	111	93	73	61	48
90	135	116	98	77	64	50
100	140	121	102	81	67	54
110	145	125	106	84	70	54
120	149	129	109	87	72	55
130	153	133	112	90	74	57
140	157	136	115	93	76	58
150	160	139	118	95	78	60
160	163	142	120	98	80	61
170	166	144	123	100	81	62
180	169	147	125	102	83	63
190	172	149	127	104	84	64
200	175	152	129	106	86	65
220	179	156	133	109	88	67
240	184	160	136	112	90	68
260	188	163	139	115	93	70
280	191	166	142	117	95	71
300	195	169	145	120	96	73
320	198	172	147	122	98	74

Age	Site 0	Site 1	Site 2	Site 3	Site 4	Site 5
340	201	175	150	124	100	75
360	204	177	152	126	101	76
380	206	180	154	128	103	77
400	209	182	156	130	104	78

Site 6 = woodland forest types that are not productive, used to indicate that this plot is a non-productive forest type, non-industrial species. This is used in the estimation of Forest Survey Site class = less than 20 cubic feet of industrial wood, and for the tree height dubbing routine, and in the top vegetation layer – potential height routine.

Site 7 = non-forest, non-productive types. This is also used in the estimation of Forest Survey Site class = less than 20 cubic feet, non-forest, and in the top vegetation layer – potential height routine.

TABLE 8. SITE CLASS IN AREAS OF CONIFER AND MIXED HARDWOOD CONIFER FOREST THAT WERE IDENTIFIED TO HAVE BURNED WITH GREATER THAN 50 PERCENT BASAL AREA LOSS ON THE ELDORADO NATIONAL FOREST

Cover Type and R-5 Site Class	>90% Mortality	50% to <75% Mortality	75% to <90% Mortality	Grand Total
0	191	45	25	**261**
1	6,923	584	396	**7,903**
2	11,851	1,078	710	**13,640**
3	3,891	253	182	**4,326**
4	794	61	42	**896**
5	439	59	43	**541**
6	0	2	0	**3**
Grand Total	**24,090**	**2,082**	**1,397**	**27,570**

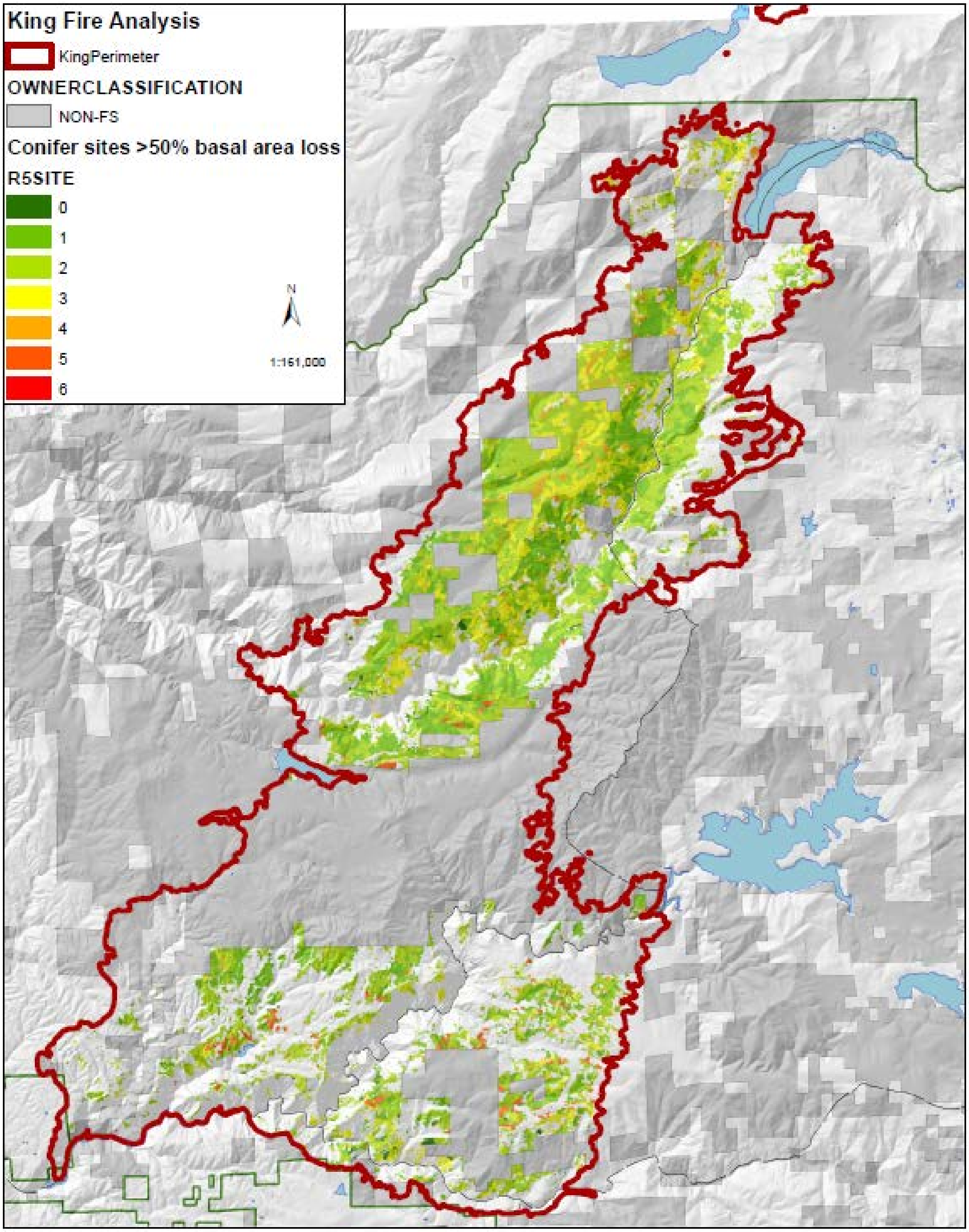

FIGURE 9. REGION 5 SITE CLASS THE ELDORADO NATIONAL FORESTWITHIN THE KING FIRE PERIMETER

DIRECTION

NATIONAL FOREST MANAGEMENT ACT OF 1976

It is the policy of the Congress that all forested lands in the National Forest System be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yield management in accordance with land management plans.

FOREST PLAN – 2004 SIERRA NEVADA FOREST PLAN AMMENDMENT

Accelerate development of old forest
Increase heterogeneity
Promote shade intolerant pines and hardwoods
Reduce risk of loss to fire *(reduce rate of spread, intensity, and mortality)*
0-2X (0-11" dbh) Plantations
Small fuels (<3") @ less than 5 tons per acre
Well-spaced tree crowns (e.g. approximately 200 tpa in 4" dbh trees)
< 50% cover in brush
Tree mortality <50% under 90 percentile weather event

R5 MINIMUM AND RECOMMENDED STOCKING FSH 2409.26B REFORESTATION HANDBOOK, 4.11

Forest Type	R-5 Site Class	Min. TPA	Recommended TPA
Ponderosa and Jeffrey Pine	0 and 1	150	200
	2	125	200
	3	100	150
	4,5	75	125
Red/White Fir	All	200	300
Douglas-fir	All	125	225
Mixed Conifer	All	150	200
Other	Forest Sup may establish as needed		

A certified silviculturist can approve alternative stocking levels based on a site-specific prescription.

RECOMMENDATIONS

Where natural regeneration is unlikely to be reliable to achieve future desired conditions within a desirable timeframe, prioritize reforestation efforts where past, pre-fire, and future climate information, and site class indicate that coniferous forest stands likely to be more sustainable and resilient into the future.

Areas that were identified as having a probability for natural regeneration should be allowed to transition through the natural stages of succession.

All areas that were identified as previously dominated by hardwoods and chaparral in the Wieslander composition mapping should be considered as a possible area of expansion.

Recognizing that future climate change will likely result in an increase in fire ignitions and area burned, consider maintaining areas that have a hardwood or chaparral component recognizing that they will be respond favorably to future high severity fire

Locations identified as high probability (>99%) of being outside the bioclimatic envelope should be allowed to naturally secede to more drought tolerant species

Focus reforestation densities and arrangement to trend stands toward desired future conditions

Reforestation and release efforts should consider resource management objectives along with slope, aspect, and landscape position in concepts presented in PSW GTR 220 and PSW GTR 237 in relation to density and species composition.

Focus release efforts to promote growth and development of forest stands where future forested conditions are identified as a desired condition.

In fire-prone areas, favor rapid development of fire-resistant stand structures ensuring reforestation strategies allow for rapid reintroduction of fire into the burned landscape at various scales.

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APPENDIX C

FIRE MANAGEMENT STRATEGY WITHIN THE KING FIRE

BRIAN EBERT, FIRE MANAGEMENT SPECIALIST, VEGETATION MANAGEMENT SOLUTIONS ENTERPRISE TEAM

BECKY ESTES, CENTRAL SIERRA PROVINCE ECOLOGIST, ELDORADO NATIONAL FOREST

KYLE JACOBSON, FOREST FUELS SPECIALIST, ELDORADO NATIONAL FOREST

ROB SCOTT, FUELS BATTALION CHIEF, ELDORADO NATIONAL FOREST

INTRODUCTION

The King fire started on National Forest System land within Calfire Direct Protection Area during the late afternoon September 13, 2014. During the overnight hours, the rollout into steep terrain of the South Fork of the American River caused the fire to grow in size and become inaccessible for direct attack. The following afternoon, the fire spotted across the South Fork American River rapidly growing in size and moving through the community of White Meadows and Silver Creek drainage. Over the course of three days the fire progressed laterally west toward the community of Swansboro and east toward Ice House Road. Significant fire growth occurred to the North on September 17, moving approximately 50,000 acres in a 24-hour period and covering 10 miles. A precipitation event slowed fire spread allowing fire suppression resources to complete direct line around the fire.

Fire is an ecological process that promotes resilience in Sierra Nevada forests. Fire was once very common throughout the Sierra Nevada and provided a primary force for shaping the structure, composition, and function of ecosystems. Future management strategies need to address the use of fire as a viable fuel-treatment tool (Agee and Skinner 2005; Stephens et al. 2009) a means to achieve large-scale prescribed burning and an important restoration treatment for many ecosystem processes stalled by the absence of frequent burning (North et al. 2012).

After the King Fire, the Eldorado National Forest (ENF) recognized the need to identify a strategy for managing activities within and adjacent to the footprint of the fire to assist with future fire management of planned and unplanned ignitions. This document is dynamic so that as new science and planning documents become available, updates can be made to reflect these changes on the landscape. The strategy is working toward desired conditions that are consistent with current ENF forest plan and the Sierra Nevada Forest Plan Amendment (SNFPA). Additionally, the strategy strives to: 1) provide resilient forest communities to predictable occurrence of future fires, 2) provide sustainable habitat for native biotic communities, and 3) reduce the risk of large-scale disturbances that have the potential to impact communities, watersheds, and ecosystems.

BACKGROUND

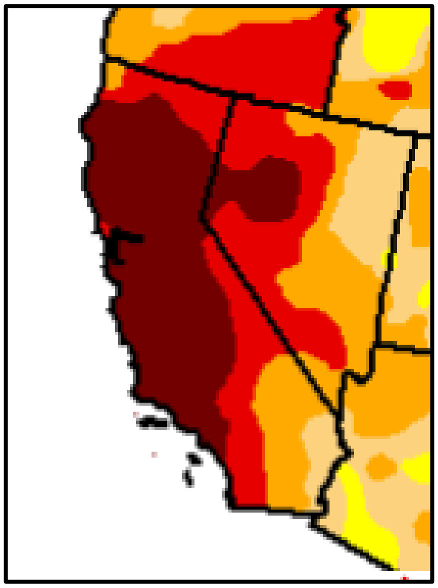


Figure 4. September 9 US Drought Monitor

WEATHER AND FUEL CONDITIONS

The combination of fuels, weather, drought, and topography affected fire behavior and ultimately containment of the King Fire. Steep inaccessible terrain hampered suppression efforts during initial attack as the fire rolled out downslope into terrain that was inaccessible to ground resources, quickly growing in size and impacting numerous communities and natural resources across the landscape. Fuel conditions can be categorized as extremely dry as much of California was in "Exceptional Drought" (Figure 4). Precipitation for the previous two years was at 50 to 70 percent of normal (NOAA 2014). A general lack of precipitation during the winter and spring 2014 led to an early fire season and extended period of fuels exposed to drying, especially large downed woody material (i.e., logs). Figure 2 displays a graph representing large fuel moisture conditions and Energy Release Component Values representing fire danger potential. Fuel conditions were well above 97th percentile weather conditions for the first three days of the King Fire. Figure displays Burning Index and weather conditions within the same timeframe. What can be seen from both figures is fuel and weather conditions were aligned in a condition to promote extreme fire behavior as fuel conditions were above 90th and 97th percentile and weather conditions were dry with wind gusts up to 34 mph.

Forest vegetation at this time showed signs of stress as needles were fading and brush species browning but leaves remaining attached to the shrub (Figure).

FIGURE 5. TIME SERIES GRAPH DISPLAYING ENERGY RELEASE COMPONENT AND 1000-HOUR FUEL MOISTURES OVER A 7-DAY PERIOD.

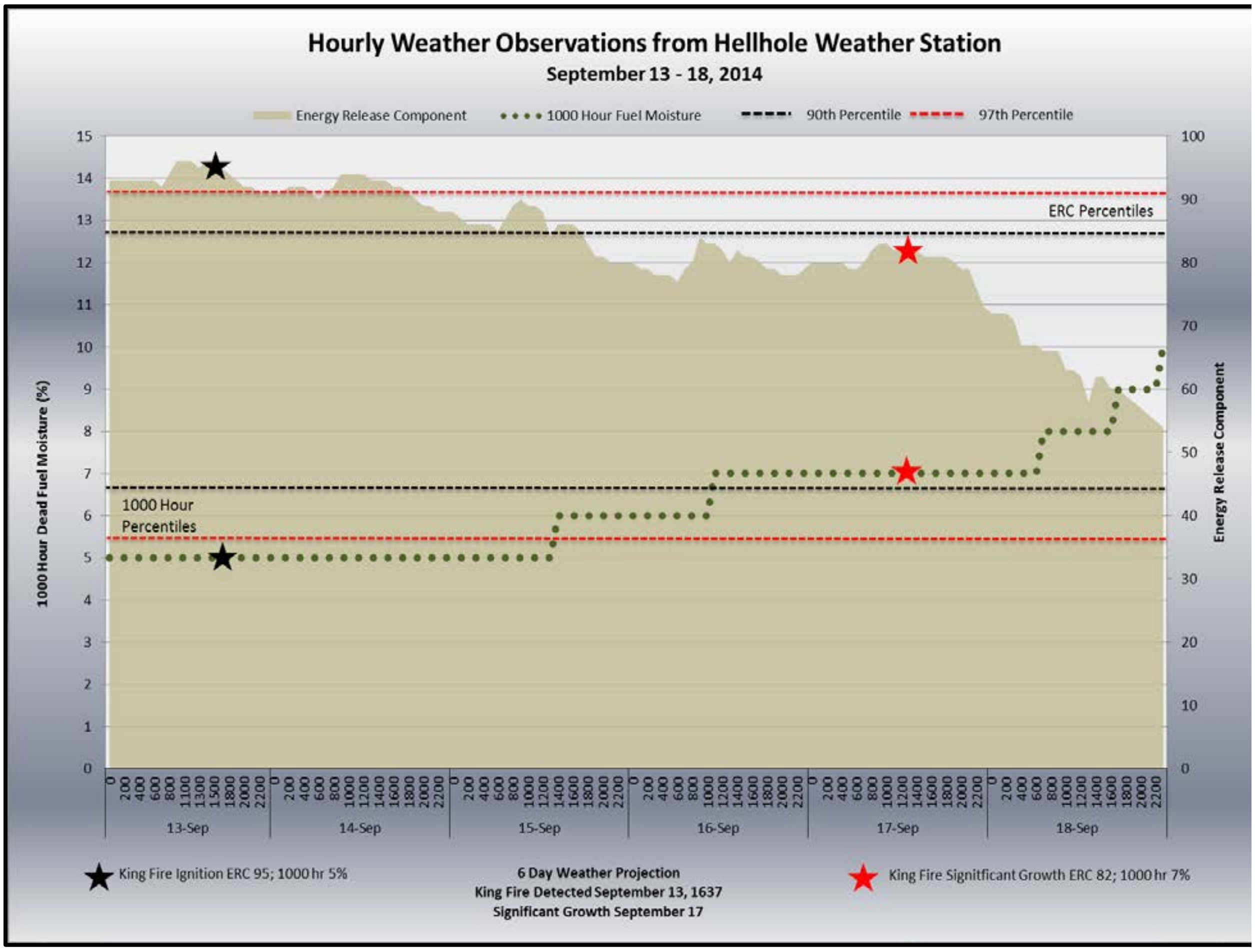


FIGURE 3. VISUAL DISPLAY OF DROUGHT STRESSED VEGETATION

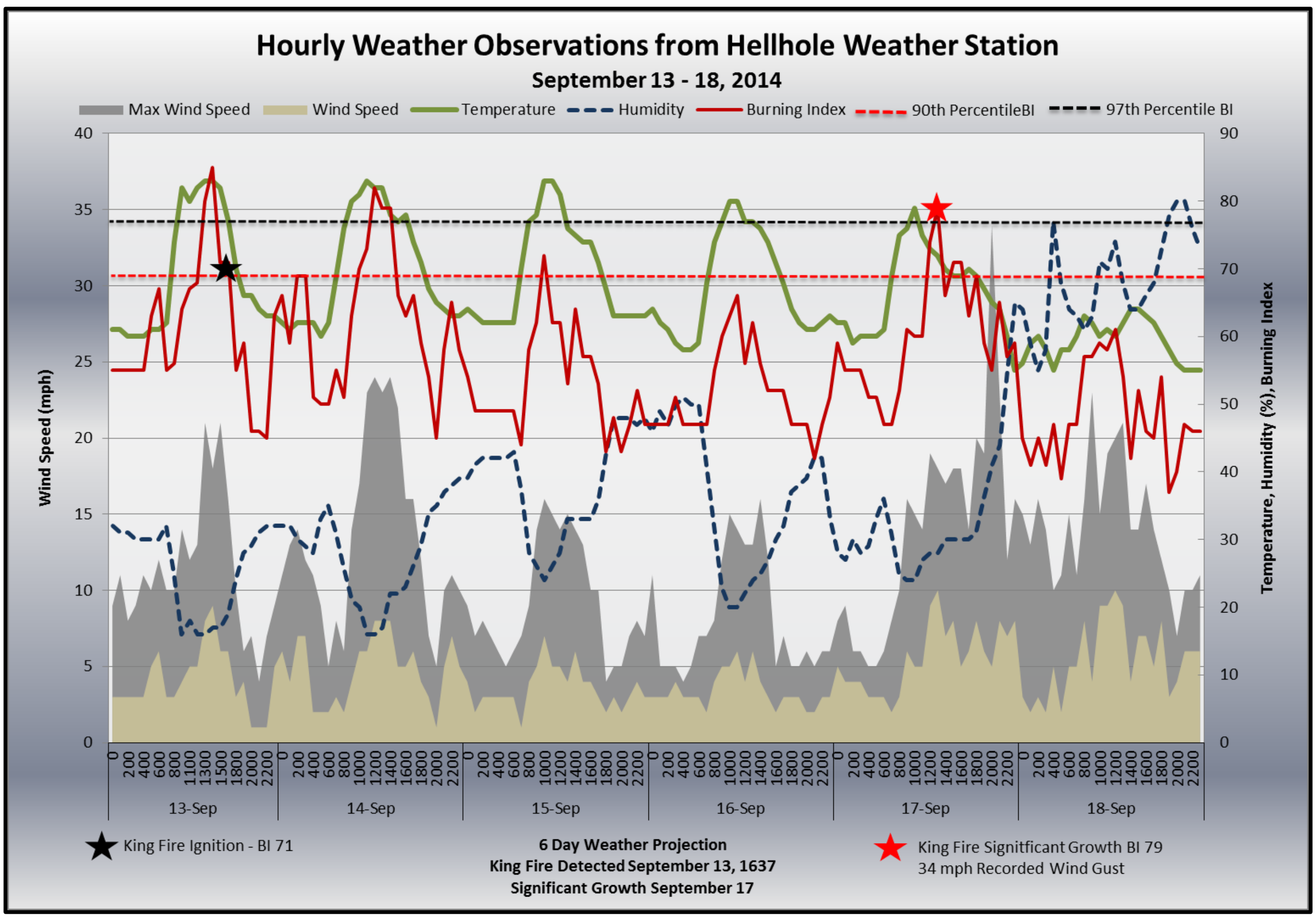
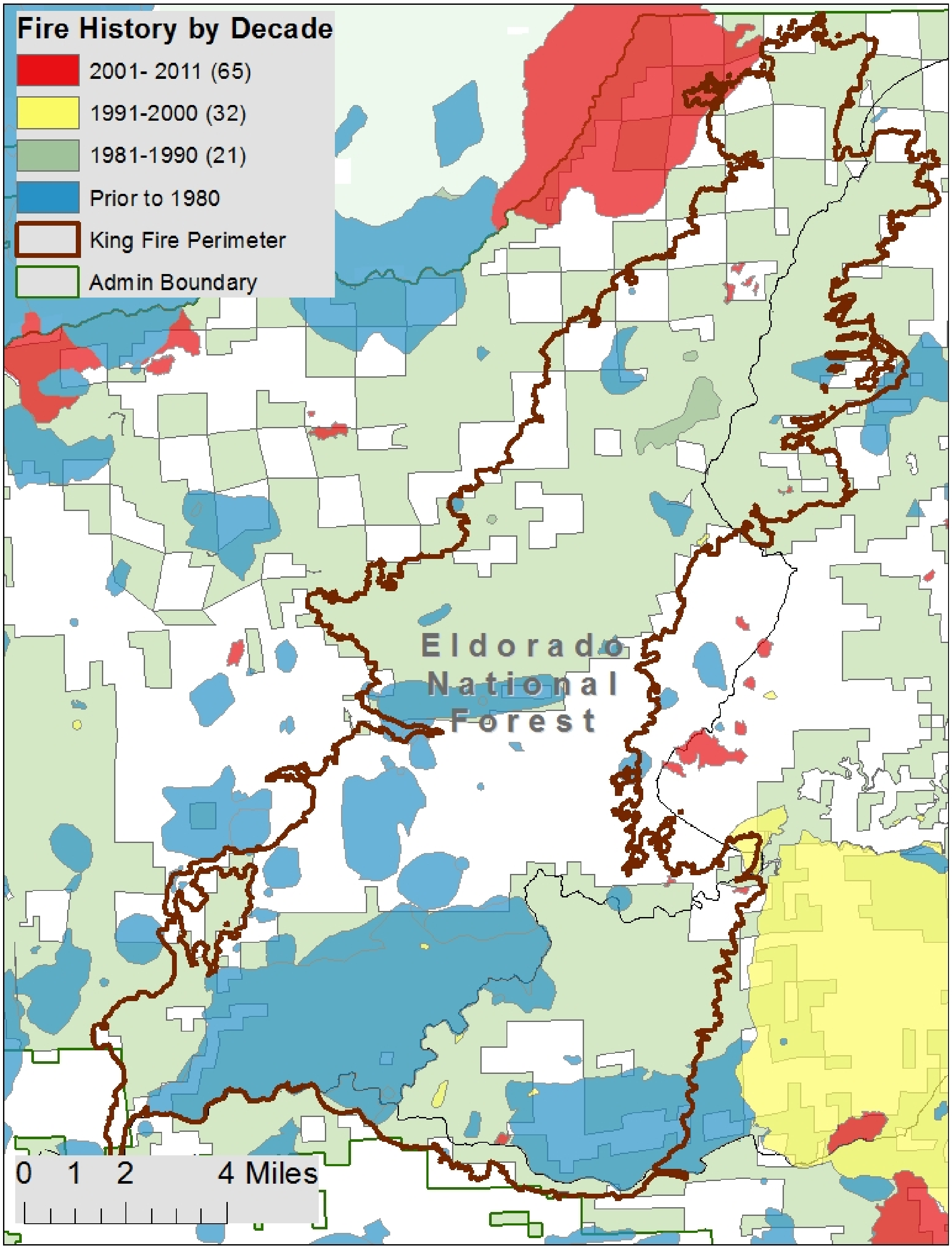


Figure 4. Weather conditions during the course of the king fire

Figure 5. Fire history in the king fire perimeter



FUEL CONDITIONS PRIOR TO THE KING FIRE

Prior to the fire, a mix of forested and non-forested vegetation existed within the King Fire Area. A large mix of the fire area had not seen fire in over 100 years (Figure 5). Within the southern portion of the fire area, the 1992 Cleveland Fire and 1959 Ice House Fire were the last large fires recorded in the fire area. Forest management activities differ upon the landscape and private timberlands intermix National Forest System Lands. Within unmanaged forested vegetation, ground fuels had high duff loadings along with large amounts of surface fuel accumulations. Extending into the mid-story canopy, small saplings and shrubs provided a uniform and continuous fuel bed into the overstory canopy fuels (Figure 6). The conditions within the King Fire have been documented throughout Sierra mixed conifer forests where fire has been excluded (Collins et al. 2011; Knapp et al. 2013).

Figure 6. stand conditions within unmanaged forested environments with little natural disturbance.

Plantations ranged in age, dependent on locations. On NFS lands, within the southern portion of the fire, plantations ranged from 20 to 50 years. Some areas were planted after the Ice House Fire (1959) and Cleveland Fire (1992). Plantation conditions depend on management activities and age as older plantations generally have open understory fuel conditions as overstory canopies shaded out the understory. In unmanaged areas and younger plantations, brush intermixed between trees creating uniform fuel beds (Figure 7).

Fuels reduction projects that have aimed to reduce surface fuel loading and overall spread and intensity of fires has been occurring within the fire area for the previous 20 years. Recent treatments have aimed to reduce fire spread and intensity by reducing natural accumulations of surface fuel loadings and thinning understory vegetation to reduce the likelihood of crown fire initiation (Figure 8).

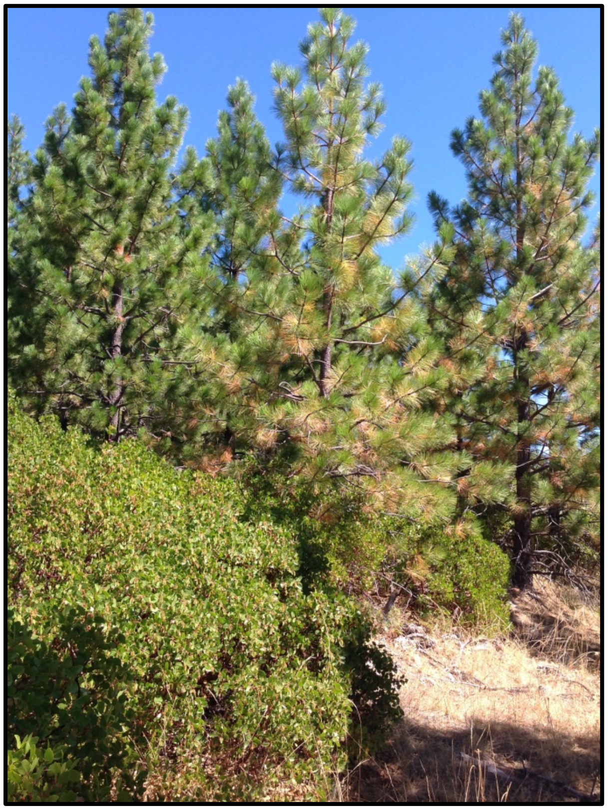


Figure 7. Plantation stand adjacent to the King fire with grass and brush understory.

Figure 8. Example of fuels reduction treatments removing understory vegetation and increasing canopy base heights.

FIRE MANAGEMENT STRATEGIES AND TACTICS

During the course of the fire, Incident Management Teams utilized a combination of strategies to contain the King Fire. Direct tactics were initially used until the fire escaped initial attack, spreading into inaccessible terrain and exhibiting extreme fire behavior (Spotting >1 mile; sustained crown runs). Once direct tactics became infeasible and the fire size exceeded the capacity of fire fighters to control the fire, indirect strategies were utilized to give resources an upper hand to get ahead of the main fire to identify control lines. This strategy provided an area to safely deploy resources to implement line construction activities and prepare fire lines for burnout operations which ignites a backing fire toward the advancing main fire. Specifically, fire managers identified:

- Road Systems – Provide quick access to control line with generally minimal line construction preparation and the ability to utilize fire engines to support holding with water support. Examples include Wentworth Springs Road, Ice House Road, Sand Mountain Boulevard.
- Ridge Systems – Generally provide access to heavy equipment and air resource support providing natural locations to burnout ahead of the main fire. Peavine, Poho, and Nevada Point Ridges are locations fire managers identified as potential ridges to hold the fire on.
- Fuels Treatments – Recent wildfires, mechanical thinning, and prescribed burn projects where fuels have been treated and can allow for quick line construction as fuel load and structure area favorable to reducing fire spread and intensity.
- Natural Features – Lakes, rivers, or barren ground that can facilitate control of line locations or places to anchor control lines from.

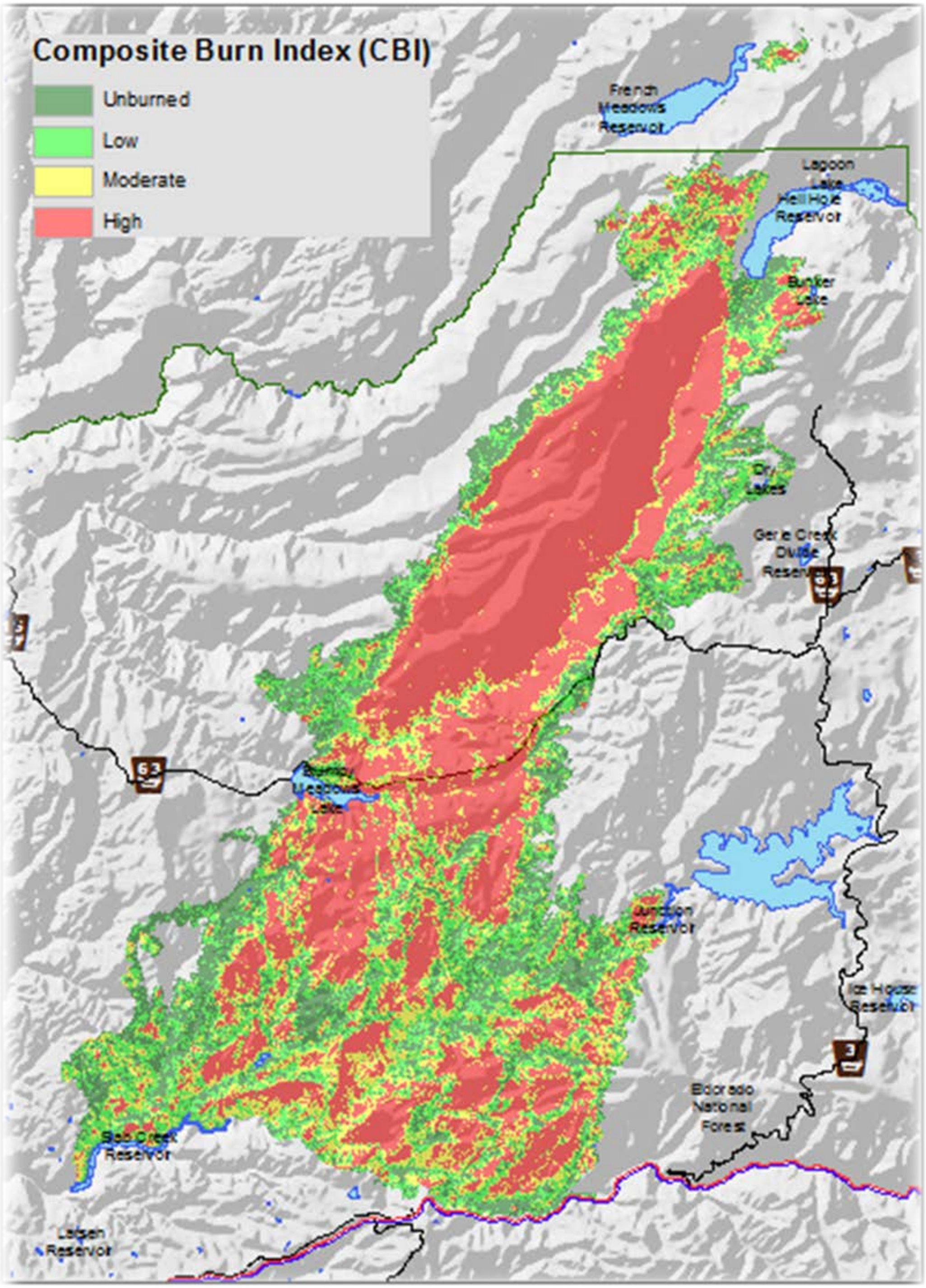
A combination of the above features were utilized to contain the King Fire with ultimately direct line construction being completed when fire behavior subsided as a result of cool moist weather. The key element is that fire managers naturally gravitate to the above features to contain a fire when direct line construction is not an option; more importantly, in frequent fire ecosystems, on many occasions these same strategic features are utilized repeatedly. The King Fire is an example in which contingency lines were constructed in locations originally utilized during the Ralston Fire (2006).

POST-FIRE FUELS CONDITIONS

The King Fire experienced a mix of severity across the landscape. Predominately the northern section of the fire area from Saddle Mountain to Hellhole experienced high severity fire effects (>75% basal area loss) with the flanks of the fire in the same area representing a mix of low and moderate fire severity (Figure 9). A detailed account of the fire can be found in the King Fire Fuel Treatment Effectiveness Report (Ebert et al. 2015).

The southern portion of the fire area burned in at mixed vegetative fire severity with pockets of high severity fire patches. Low to moderate severity burn areas intermix high severity areas to break the continuity of high severity patches compared to the northern portion of the fire area.

Figure 9. Preliminary vegetation severity map (RAVG) classified by the Composite Burn Index (CBI).



High Severity fire areas experienced crown fire activity resulting in full consumption of ground, surface, and aerial canopy fuels. At the ground and surface fuel level, duff and needle cast, small branches, and large downed woody material were fully consumed; in the canopy stratum, full consumption of leaf and needle foliage occurred leaving standing dead trees and barren soils (Figure 10 and Figure 11).

FIGURE 10. EXAMPLE OF HIGH SEVERITY FIRE EFFECTS.

Moderate to high severity fire areas experienced similar conditions; surface fuel loadings were primarily fully consumed; pockets of larger downed fuels remain visible on the surface. Generally, full consumption occurred within all categories of surface fuel loads (i.e., small branches, twigs, and large downed woody debris); and dead needles continue to fall from the canopy covering the forest floor (Figure 12). The crown fuel profile varied with some trees being consumed by the fire and other trees retaining needles in the tree canopy (Figure 13).

The majority of aerial canopy structure burned intensely enough to result in brown needles with few green needles remaining on conifer trees and full consumption of hardwood species.

FIGURE 11. CANOPY VIEW OF HIGH FIRE SEVERITY PATCH.

FIGURE 12. MODERATE TO HIGH SEVERITY FIRE WITHIN SURFACE AND MID-STORY CANOPY FUELS.

FIGURE 63.
MODERATE TO HIGH SEVERITY FIRE WITHIN THE CANOPY FUELS.

Low to moderate severity stands have a mix of live and dead trees remaining within the understory. Primarily, overstory crown fuels remain intact and survived the fire while surface fuels and small tree (understory) mortality occurred within the understory crown fuel profile (Figure 14).

FIGURE 14. LOW SEVERITY FIRE EFFECTS

POST-FIRE FUELS MANAGEMENT STRATEGY

BACKGROUND/ASSUMPTIONS

The King Fire highlighted the effectiveness of fuels treatments that aimed to reduce the spread and intensity of fire. During the course of the fire, fire mangers utilized multiple fuel treatment areas in their effort to contain the fire. Poho Ridge which included the Hey Joe Fuels Reduction Project and Purple Haze Mastication Project were utilized as areas to build fire line with planned burnout operations. Ultimately, portions of the Quintette and Treeage Fuels Reduction Projects assisted to facilitate line construction and successful burnout operations.

This paper assumes that within high severity patches we can expect grass and shrubs to reestablish in once forested conifer stands. Within low to moderate severity areas that still remain forested, accumulation of foliage and small woody material will continue to increase over time along with regrowth of shade tolerant vegetation in the absence of fire or other forest management activities.

Experience from previous large fires across the Sierra Nevada shows that areas which encountered high severity fire can be ready to reburn again in as little as 10 years. The Chips Fire (Plumas NF, 2012) burned within the footprint of the Storrie Fire (2000); the Kyburz Fire (Eldorado NF, 2013) burned within the Freds Fire (2004) and the Big Meadow Fire (Yosemite NP, 2009) burned within the 1996 A-Rock Fire scar. These examples highlight the fact that we can assume reburn within the King Fire area is probable as early as 10 to 20 years.

Based on these assumptions, without any management activities we can expect high severity fire areas to reestablish with non-forested vegetation, mainly shrub fuels, with standing dead timber, for the next 10 to 20 years, or longer, and promote problem fire behavior and high resistance to control. Over time, snags will fall and contribute to surface fuel loading and subsequent fire behavior as these materials continue to decay becoming readily available to ignition and long duration, high intensity burning.

The King Fire Management Strategy was designed to identify locations where managing activities within and adjacent to the footprint of the fire will help to assist with future fire management of planned and unplanned ignitions. From a fire management perspective, there is a need to manage portions of the post-fire landscape in order to facilitate future fire management activities which includes managing planned and unplanned fire ignitions (Figure 15).

IMPORTANCE OF PRESCRIBED AND MANAGED FIRE

Fire is an indispensable management tool, capable of doing much of the work to restore ecological processes (Covington et al. 1997; Stephenson 1999; Sugihara et al. 2006; North et al. 2012). Prescribed and managed fire has also been identified as the primary means to treat large landscapes particularly in areas where mechanical treatment are limited due to access (North et al. 2012).

In many stands, mechanical thinning followed by prescribed fire may be necessary to achieve forest resilience much faster than with prescribed fire alone (Stephens et al. 2009). Surface fuels merit as much attention as ladder fuels when stands are treated. Prescribed fire is generally the most effective tool for reducing surface fuels. Recent research has also shown that prescribed fire treatments either before or following plantation establishment can increase the likelihood of survival following a fire (Kobziar et al. 2009).

Following large-scale fires, an opportunity exists to define a landscape-scale strategy to realign fire treatments within the area (Figure 14). Prescribed fire units can be defined as part of the fire shed analysis based on fire behavior modeling and expert opinion. The units could have three primary objectives: 1) reintroduction of fire on a short rotation interval to break up the continuity of post-fire fuels, 2) maintenance of areas that burned at low and moderate severity within the pre-European fire return interval, and 3) facilitate prescribed fire in projects under previous decisions.

RECOMMENDATIONS

Utilize local fire management and fire history to identify strategic fire management areas, which will identify locations to reduce the spread and intensity of fires and allow for safe and effective fire suppression activities on future planned and unplanned ignitions.

Wildland Urban Interface

Strategic Fire Management Areas

Strategic Road Systems

Natural Barriers

Focus the greatest intensity of fuel treatments within the Wildland Urban Interface focusing on providing safe ingress/egress of public and fire suppression resources and reducing snag densities and surface fuel loading to reduce problem fire behavior; namely, spot fire ignition, reduction of flame lengths to less than four feet and surface fuel loadings that reduce the spread of wildland fires which allows quick suppression response to contain fire as soon as possible.

Identify fuels treatments that aim to reduce future fire behavior including flame length, intensity, crown fire initiation, and spot fire potential.

Develop fuels treatments to reduce the stand density of snags and subsequent surface fuel loading potential these standing dead trees are storing.

Within low to moderate severity burn areas, cut and pile dead vegetation and prune the canopy of retained trees to decrease future connectivity of surface and canopy fuels.

Reduce snag densities to the least number of snags needed for other physical and biological processes maintaining any snags retained in clumps.

Actively manage these areas in the future as vegetation reestablishes and grows to maintain a system of strategic management areas to contain future fires.

Consider the footprint of the King Fire as a place to reinitiate prescribed fire on a larger scale.

Utilize prescribed fire as a second entry to retain frequent low intensity fire regimes, especially within low and moderate severity fire areas.

Continue to utilize fire within the Hey Joe, Quintette, and Treeage Fuels Reduction Projects along with numerous fuels treatments along Peavine Ridge and Jay Bird Road to maintain already low surface fuel loadings, and continue frequent low intensity burns.

Utilized prescribed fire to break the continuity of shrub regrowth in areas where other forest management activities are not feasible.

Utilize aerial ignition within the Rubicon River drainage (i.e., helitorch) to create patches of burn areas where anticipated vegetation is continuous shrubfields.

Coordinate with other resources to develop management activities that continue to support fire management strategies.

Reforestation is an important component in ecological restoration goals to restore forested vegetation.

Identify planting methods and locations of reforestation and focus future management activities within forested areas to maintain low surface fuel loadings and as soon as practical prune vegetation to increase canopy base heights and break the continuity of fuels both horizontally and vertically.

Identify desired conditions for surface fuel loadings for fire management coordinating with other resource specialties to maintain physical and biological processes in the ecosystem.

Identify future fuels reduction projects outside of the footprint that can connect with treatments in the King Fire area.

Reduce surface fuel loading.

Increase canopy base height.

Break continuity of overstory crown fuels, especially near the edge of steep canyons and drainages.

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APPENDIX C

CONTRIBUTION OF FIRE MODELING TO THE OVERALL FUELS TREATMENT STRATEGY ON THE KING FIRE

METHODOLOGY

FIRE MODELING

Modeling fire growth across the landscape provides an opportunity to visually look at the growth potential under a set of weather conditions. The FlamMap fire behavior modeling program provides the option of visually observing “major flow paths” utilizing the Minimum Travel Time Fire Growth Model. In essence, these flow paths are the prediction a fire would travel given the weather, fuels and topography inputs required by FlamMap and an ignition on the landscape. What is unique about FlamMap is the modeling can be looked at under one set of weather conditions; therefore, the alternatives can be compared under one set of conditions.

The Minimum Travel Time (MTT) feature is a two-dimensional fire growth model. It calculates fire growth and behavior by searching for the set of pathways with minimum fire spread times from point, line, or polygon ignition sources. In theory, the results are identical to wave-front expansion used in *FARSITE* with the exception that all weather and fuel moisture conditions are held constant over time with MTT, but allowed to vary in time in *FARSITE*.

At a user specified resolution of data cells, the algorithm finds the minimum travel paths by calculating travel times from each node (cell corners) to every other node on the landscape. Travel pathways are straight lines that connect nodes and intersect cells to form segments for which fire behavior is calculated from the input data (Finney et al. 2006).

The importance of looking at the major flow paths of a modeled fire can provide insight into specific areas on the landscape where a combination of fuels and topography may branch into multiple flow paths. Thus, the MTT calculations can generate fire growth in the absence of time-varying winds or moisture content which enables analysis only of the effects of spatial patterns of fuels and topography (Finney, 2006).

Pre-fire fuel models are utilized to model potential fire behavior for this project. The idea of the fuels strategy is to identify those areas that have the potential risk of large fire growth in the future; utilizing the pre-fire models allows fire managers to identify future problem fire areas. It is assumed that vegetation will establish and grow overtime. While there may be a species composition change, it is anticipated that there will be an issue with surface fuel loading and subsequent fire behavior over time.

To model predicted fire behavior, a climatological weather was utilized to obtain 90th percentile weather conditions in the vicinity of the King Fire. Both the Bald Mountain and Hellhole Remote Automated Weather Stations were used to develop weather and fuel moisture inputs for use in modeling fire behavior (Table 4). For the purposes of modeling, wind speed was chosen at 25 mph with upslope winds. During the September 17 large fire growth day, winds at the Hellhole RAWS were recorded at 12 mph, gusting to 34 mph.

TABLE 4. 90TH PERCENTILE WEATHER CONDITIONS WITHIN THE KING FIRE AREA

90th Percentile Weather Bald Mountain & Hellhole RAWS	
1 - Hour Dead Fuel Moisture	3%
10 - Hour Dead Fuel Moisture	4%
100 - Hour Dead Fuel Moisture	5%
1000 - Hour Dead Fuel Moisture	6%
Live Woody Fuel Moisture	69%
Herbaceous Fuel Moisture	30%

Figures 1-3 highlight the analysis completed to identify strategic fuels zones. Identifying the branching “nodes” within the MTT run assist with fuel zone location placement; the theory being that if we can alter fuels within this area, modifying the fire behavior will reduce chance that the branching of the nodes would occur. As can be seen from the figures, following the branching out, further branching occurs. An example of this is highlighted from the King Fire within the Hey Joe Project Area where 500 acres of prescribed fire was accomplished within and adjacent to mechanical thinned units 10 months prior to the ignition of the King Fire. Fire activity was arrested in the units and what can be observed is the fire entered the stands as active crown fire and modified to surface fire behavior activity. The main fire eventually flanked around the treatment units; however, fuels in the treatment modified fire behavior compared to outside the treated area.

Figure 7. FlamMap minimum travel time run indicating areas of potential growth.

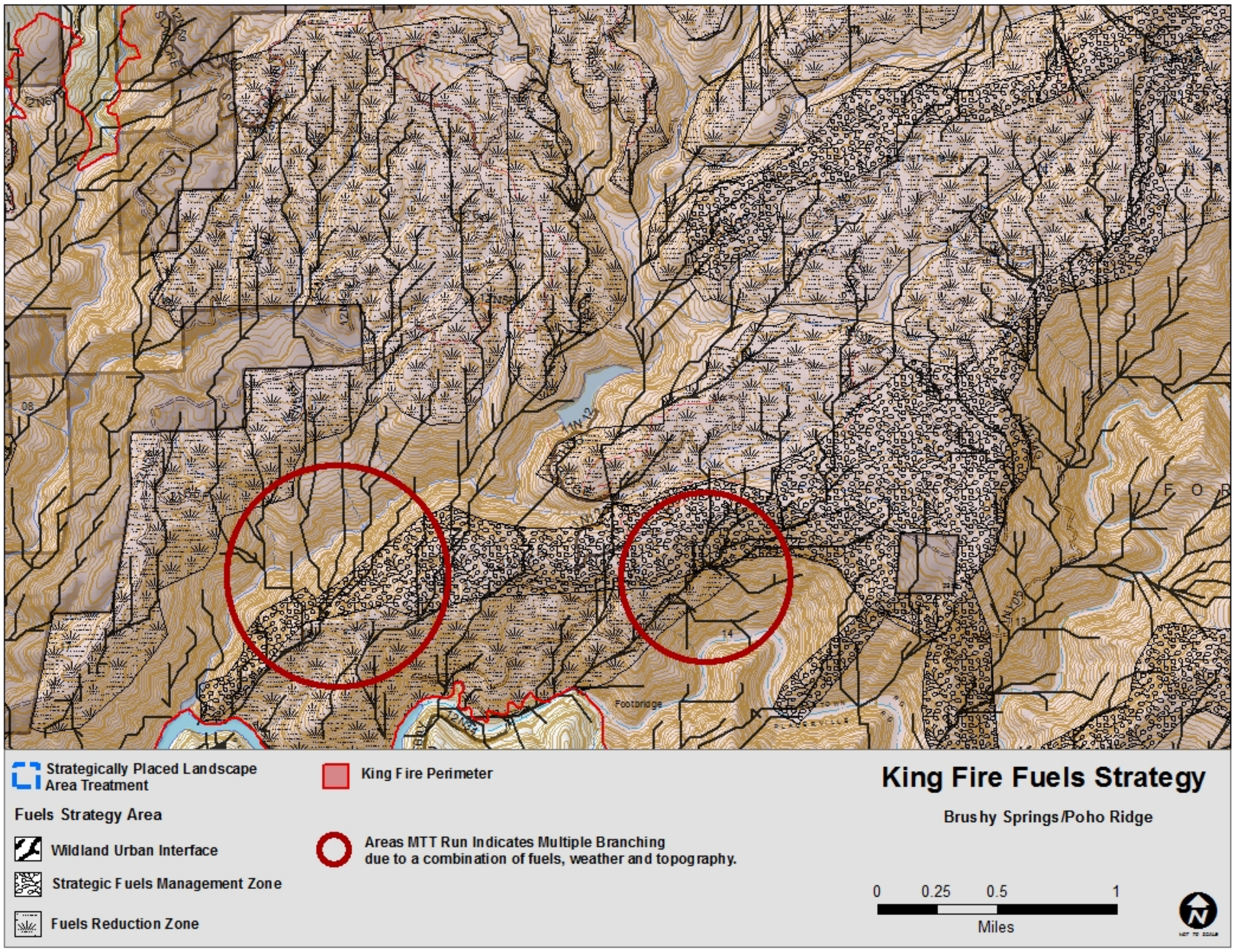


FIGURE 8. FLAMMAP MINIMUM TRAVEL TIME RUN INDICATING AREAS OF POTENTIAL GROWTH.

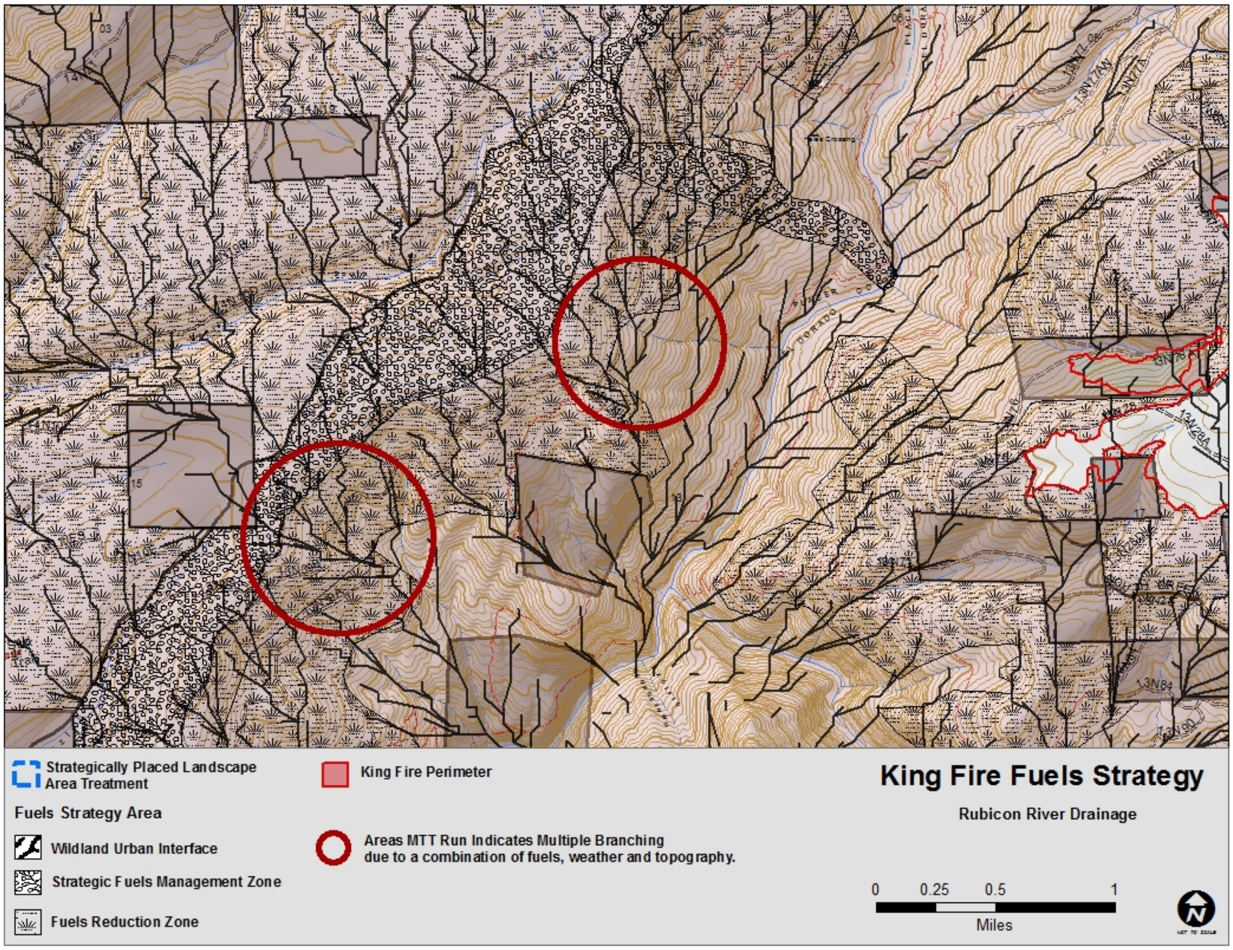
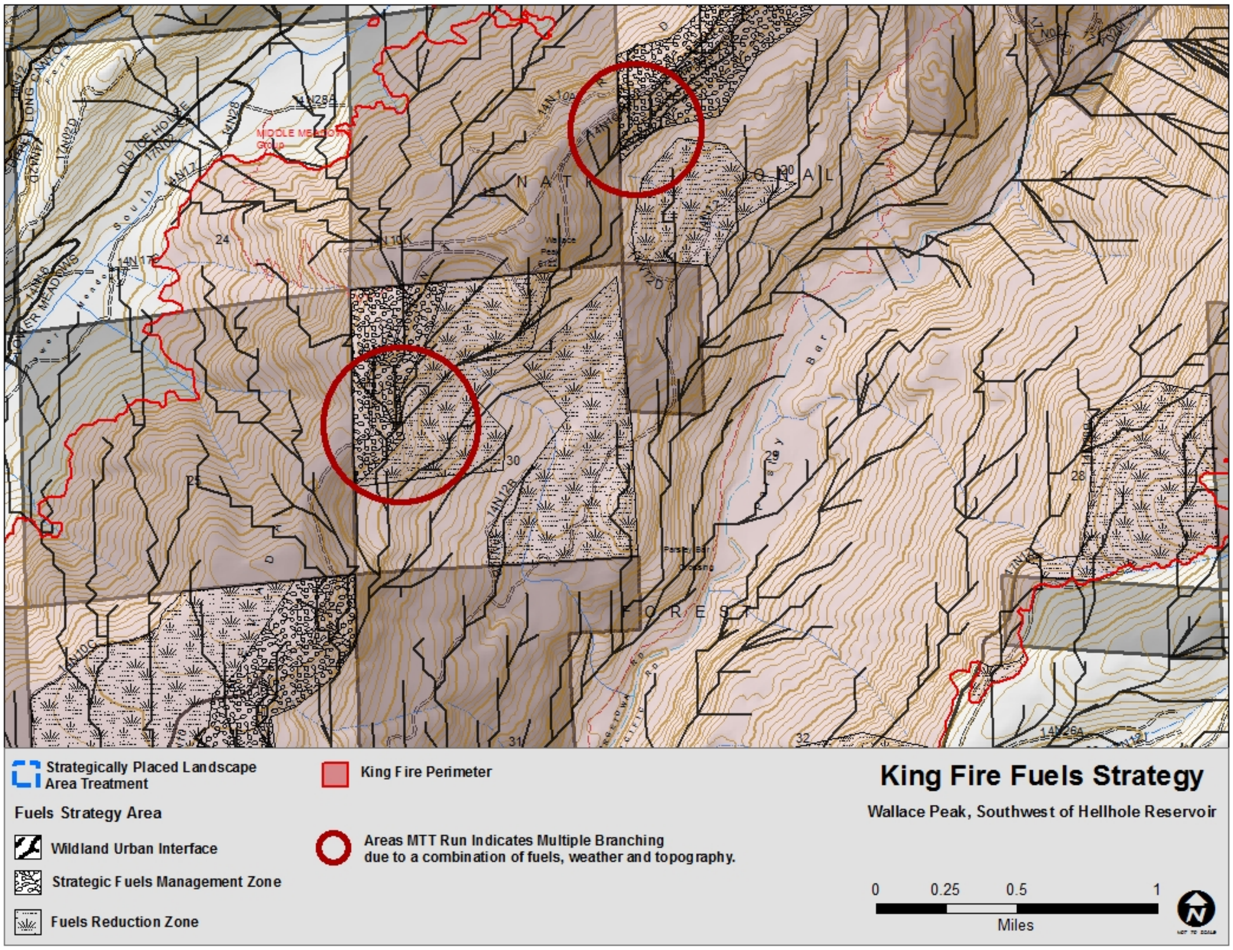


FIGURE 9. FLAMMAP MINIMUM TRAVEL TIME RUN INDICATING AREAS OF POTENTIAL GROWTH.



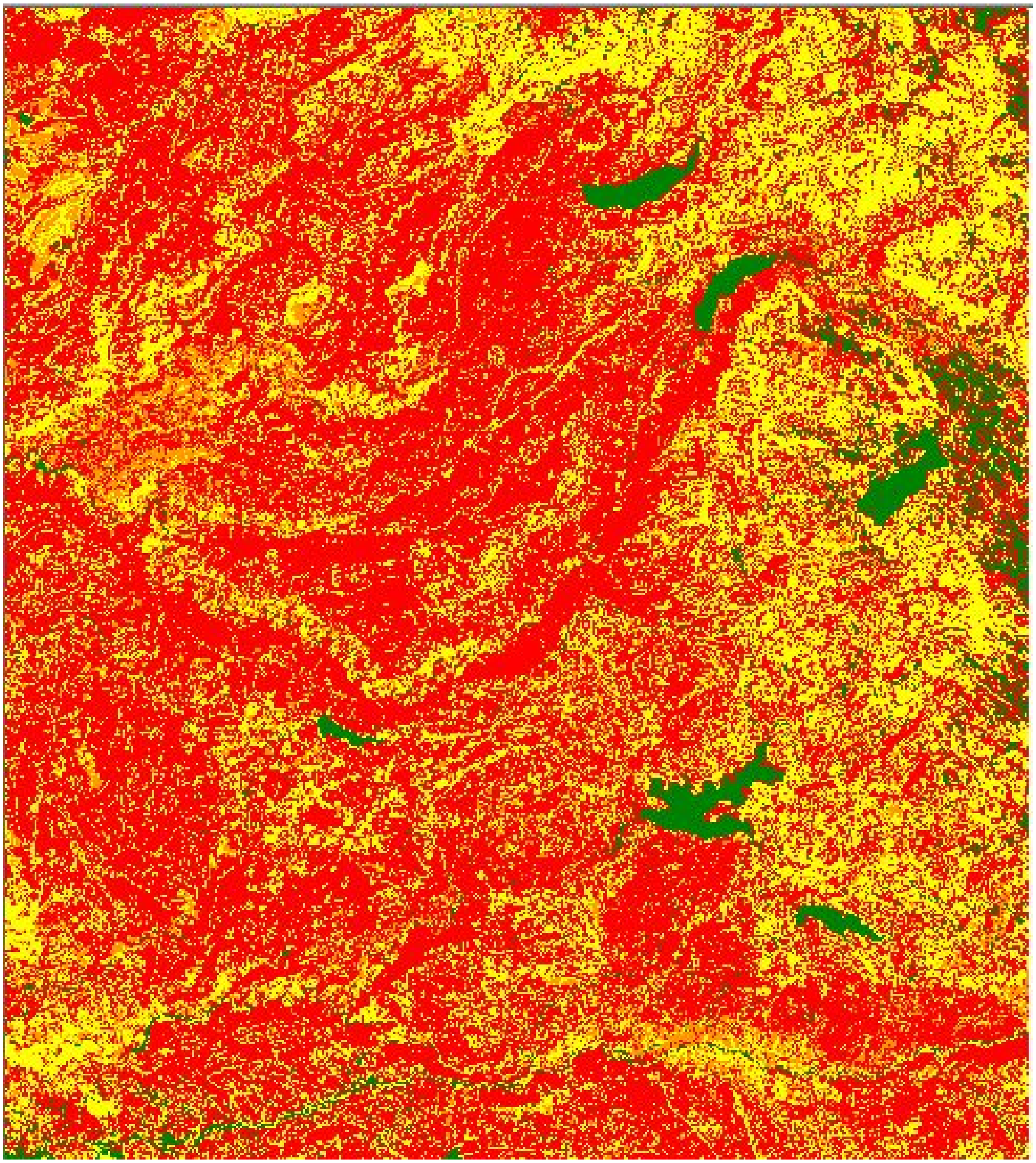


FIGURE 4. FLAMMAPFLAME LENGTH IN THE KING FIRE PERIMETER. RUNS WERE BASED ON PRE-FIRE VEGETATION LAYERS

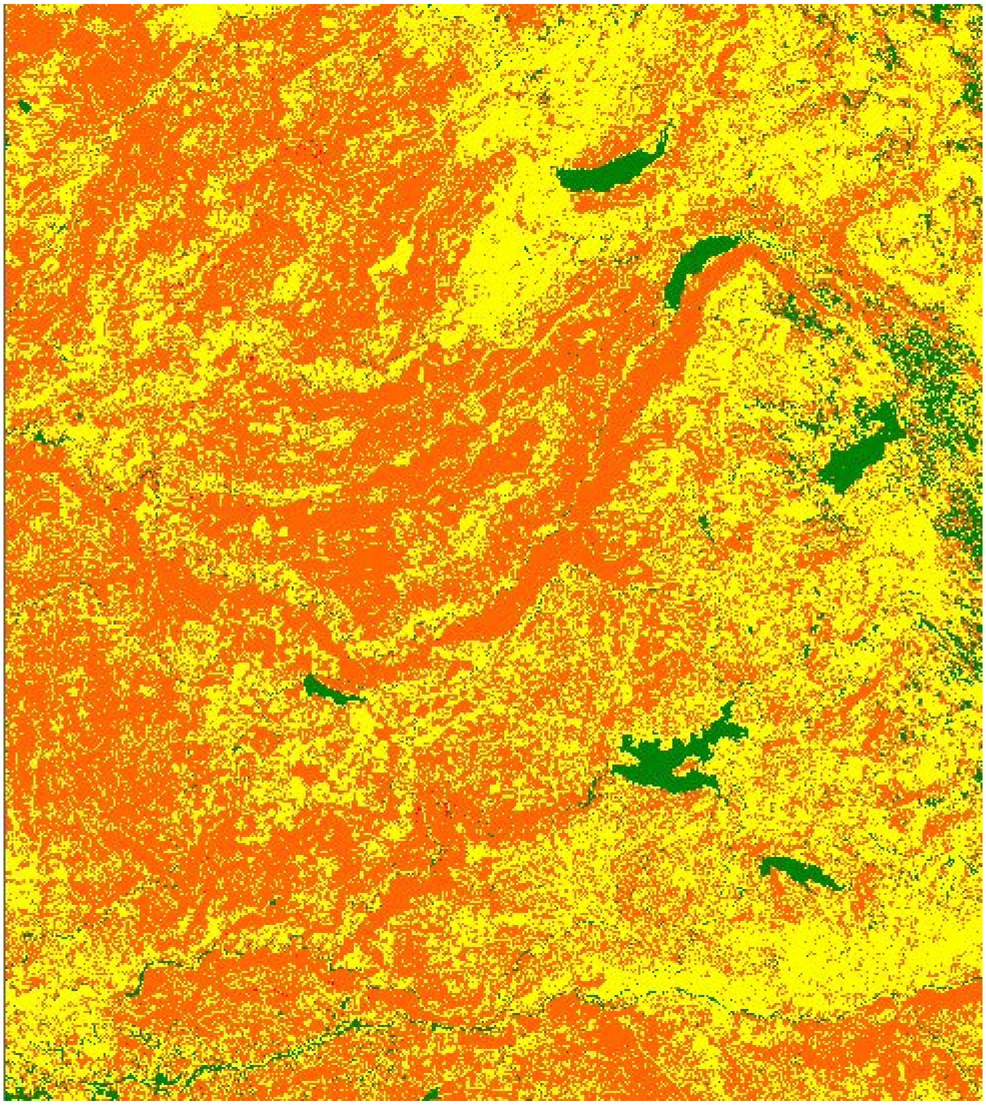


FIGURE 5. FLAMMAPPOTENTIAL FOR CROWN FIRE IN THE KING FIRE PERIMETER. RUNS WERE BASED ON PRE-FIRE VEGETATION LAYERS

PROFESSIONAL JUDGMENT

Utilizing fire and fuels management staff, key geographic locations and feasible areas that could be managed with future treatments were identified. This included the process of identifying ridge systems, roads, and natural features that could be utilized as potential control lines to contain a wildland fire. A review of previous fuels reduction projects was a key indicator to locate important fire management features. The intent of these projects was to reduce surface fuel loading and crown fire activity within the treated areas and facilitate future treatments within the fuels strategy. These documents provided fire modeling to logically support the effects of the proposed treatments on fire behavior, beyond what is shown here.

STRATEGICALLY PLACED LAND AREA TREATMENTS (SPLATS)

Strategically placed [land] area treatments are blocks of land, ranging anywhere from 50 to over 1,000 acres, where the vegetation has been treated to reduce fuel loading. The treatment areas are placed so that a spreading fire does not have a clear path of untreated fuels from the bottom of the slope to the ridge top. Managers consider historic fire regimes and the potential for severe wildfires (based on fuel loading, prevailing wind direction, and terrain features) in deciding where to place area treatments. Strategically placed area treatments are designed to burn at lower intensities and slower rates of spread during wildfires than comparable untreated areas. Hence, wildfires are expected to have lighter impacts and be less damaging in treated areas. The SPLAT strategy treats a relatively large proportion of the landscape, and this strategy facilitates fire reintroduction (Biological Assessment for SNFPA SEIS Final, July 30, 2003). Within the King Fire Perimeter, 12,650 acres of SPLATS have been identified. **TABLE 5** displays the acreages of SPLATS broken out by Fuels Strategy Area.

TABLE 5 ACRES OF SPLATS WITHIN FUELS STRATEGY AREAS.

Fuels Strategy Area	Acres
Wildland Urban Interface	0
Strategic Fuels Management Treatment	3,664
Fuels Reduction Zone	7,237
Total	**10,901**

STRATEGIC FUELS MANAGEMENT STRATEGY

Three types of potential treatment areas were identified based on a combination of factors related to future fire management strategy, fire hazard and risk, and areas where treatments could feasibly be implemented with future activities. Fire managers reviewed Geospatial layers including: Wildland Urban Interface, Road system, LMU, Strategic Placement of Land Area Treatment (SPLATs), and fire modeling outputs including flame length, fire line intensity, and minimum travel time flow paths.

WILDLAND URBAN INTERFACE

In wildland urban intermix (WUI) defense zones, management activities are focused on protecting life and property (Sierra Nevada Frame Work). The following are fire management goals within the WUI zone.

Fire Management Goals

- Reduce future fuel loadings adjacent to WUI Defense Zones (Used WUI layer)
- Retain the least amount of snags possible within the WUI; keep snag locations as far away from homes and road systems.
- Decrease resistance to control of future fires in the WUI by prioritizing projects to reduce surface fuel loading and vertical fuels arrangements that minimize crown fire activity.
- Provide safe areas for ingress/egress of public and firefighters.
- Promote future fuels management projects in the area aimed at reducing fuel loading from future vegetation regrowth.

Any new fire starts would be kept small enough to permit fire suppression resources to quickly suppress fires.

STRATEGIC FUELS MANAGEMENT ZONE

Fire managers utilize strategic locations to contain unplanned ignitions along with facilitating prescribed fire implementation. These features include natural barriers such as lakes and rivers, road and ridge systems.

Fire Management Goals

- Reduce hazardous fuels in key locations to reduce fire spread and intensity.
- Reduce snags and future surface loadings in post high fire severity areas to minimize fire behavior.
- Provide key areas where firefighting resources can utilize locations to establish anchor points to contain wildland fires.
- Hazards to firefighters are reduced by managing snag levels in locations likely to be used for control of fire suppression and prescribed fire operations.
- Maintain vegetation and fuel loading to support increased line production rates and decrease resistance to control of future wildland fires.
- Maintain snags in the area utilizing clumps where feasible located 200 feet from the top of the ridge.

FUELS REDUCTION ZONE

Fuels reduction zones are generally located adjacent to Strategic Management Zones as well as within identified SPLATS and previous fuels reduction projects. The purpose is to modify fire spread and intensity where fire modeling indicates a potential increase in fire spread within the area. The goal is to increase future fire resilience and allow for implementation of future fuels management projects; namely, prescribed fire and reforestation.

Fire Management Goals

- Strategically place fuels reduction zones where future treatments may create a pattern of treatments to modify the fire spread across the landscape and break the continuity of surface fuel loadings.
- Increase fire resilience within fuels reduction zones utilizing prescribed fire and other fuels management activities to reduce and maintain surface and canopy fuels to the level necessary to produce surface fire activity within treated stands.
- Utilize an integrated approach to develop fuel treatments which meet fire management goals while considering other ecosystem needs and processes.
- Utilize a collaborative approach to determine the density and location of snags within Fuels Reduction Zones.

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Appendix D: Road Repair and Maintenance

Maintenance Level	
1	BASIC CUSTODIAL CARE (CLOSED TO THE PUBLIC)
2	HIGH CLEARANCE VEHICLES
3	SUITABLE FOR PASSENGER CARS
4	MODERATE DEGREE OF USER COMFORT

RD_NO	NAME	MTCE. LEVEL	SURFACING	EST. MILES	TREATMENT
11N12	POHO RIDGE	2	P - PAVED	1.39	MAINTAIN
11N35	VLECK CREEK	2	NAT - NATIVE MATERIAL	0.55	MAINTAIN
11N57	ROUNDTENT CANYON	4	BST - BITUMINOUS SURFACE TREATMENT	4.14	MAINTAIN
11N57	ROUNDTENT CANYON	4	BST - BITUMINOUS SURFACE TREATMENT	0.63	MAINTAIN
11N59	SOLDIER CREEK	2	NAT - NATIVE MATERIAL	3.28	MAINTAIN
11N60	JAYBIRD SPRING	4	BST - BITUMINOUS SURFACE TREATMENT	4.75	MAINTAIN
11N60B	JAYBIRD NORTH	2	NAT - NATIVE MATERIAL	1.20	MAINTAIN
11N60C	TENT CANYON	1	NAT - NATIVE MATERIAL	2.18	MAINTAIN
11N63	WEST PEAVINE RIDGE	2	NAT - NATIVE MATERIAL	2.48	MAINTAIN
11N64	SPRING VALLEY	3	NAT - NATIVE MATERIAL	4.51	MAINTAIN
11N64C	SILVER TIP	2	NAT - NATIVE MATERIAL	0.84	MAINTAIN
11N70	MCMANUS	2	NAT - NATIVE MATERIAL	2.15	MAINTAIN
11N71	JAYBIRD CANYON SPRING	2	NAT - NATIVE MATERIAL	0.20	MAINTAIN
11N76	INDIAN HATTIES	2	NAT - NATIVE MATERIAL	0.64	MAINTAIN
11N78	N78	2	NAT - NATIVE MATERIAL	0.74	MAINTAIN
11N80	SOUTH BIG X	2	IMP - IMPROVED NATIVE MATERIAL	6.16	MAINTAIN
11N80A	OVER BIG X	2	NAT - NATIVE MATERIAL	0.66	MAINTAIN
11N93	WINDING WAY	1	NAT - NATIVE MATERIAL	0.91	MAINTAIN
11NY05	CROOKED SILVER	2	NAT - NATIVE MATERIAL	3.44	MAINTAIN
11NY20	GASPARNI	2	NAT - NATIVE MATERIAL	1.29	MAINTAIN
11NY20	GASPARNI	2	NAT - NATIVE MATERIAL	0.71	MAINTAIN
11NY22	X-RAY	1	NAT - NATIVE MATERIAL	0.46	MAINTAIN
11NY22A		1	NAT - NATIVE MATERIAL	0.32	MAINTAIN
12N19	CLAUSSENIUS	2	NAT - NATIVE MATERIAL	1.03	MAINTAIN
12N29E	STUMPY MEADOWS CAMPGROUND	3	AC - ASPHALT	0.50	MAINTAIN
12N34	FOREBAY	2	IMP - IMPROVED NATIVE MATERIAL	6.80	MAINTAIN
12N34	FOREBAY	3	BST - BITUMINOUS SURFACE TREATMENT	7.61	MAINTAIN
12N34K		2	NAT - NATIVE MATERIAL	1.40	MAINTAIN
12N34L	SADDLEBACK	2	NAT - NATIVE MATERIAL	0.85	MAINTAIN
12N43	WATER CANYON	2	NAT - NATIVE MATERIAL	1.08	MAINTAIN
12N43A	WATER CANYON #1	2	NAT - NATIVE MATERIAL	0.22	MAINTAIN
12N43B	WATER CANYON #2	2	NAT - NATIVE MATERIAL	0.28	MAINTAIN

RD_NO	NAME	MTCE. LEVEL	SURFACING	EST. MILES	TREATMENT
12N46	VAUGHN	2	NAT - NATIVE MATERIAL	0.58	MAINTAIN
12N47	ELEVEN PINES RIDGE	2	NAT - NATIVE MATERIAL	0.49	MAINTAIN
12N51	LEONARDI SPRINGS LOOP	2	NAT - NATIVE MATERIAL	1.39	MAINTAIN
12N51A	LENARD	2	NAT - NATIVE MATERIAL	1.23	MAINTAIN
12N53	KINGS MEADOW	2	NAT - NATIVE MATERIAL	0.72	MAINTAIN
12N53C	53CA	1	NAT - NATIVE MATERIAL	0.18	MAINTAIN
12N54	SUGAR PINE LOOP	2	NAT - NATIVE MATERIAL	3.16	MAINTAIN
12N54A	SUGAR WATER	1	NAT - NATIVE MATERIAL	0.71	MAINTAIN
12N54B	SUGAR PINE FLAT	1	NAT - NATIVE MATERIAL	0.11	MAINTAIN
12N54D	CROSSWIRE	1	NAT - NATIVE MATERIAL	0.44	MAINTAIN
12N54W	54W	1	NAT - NATIVE MATERIAL	0.04	MAINTAIN
12N56	BIG X MTN	2	NAT - NATIVE MATERIAL	2.70	MAINTAIN
12N57	BUTCHER KNIFE JOE	2	NAT - NATIVE MATERIAL	3.67	MAINTAIN
12N57F	BUTCHER JOE TIE THRU	1	NAT - NATIVE MATERIAL	0.25	MAINTAIN
12N57X	57X	2	NAT - NATIVE MATERIAL	0.21	MAINTAIN
12N58	CAMP SIX	2	NAT - NATIVE MATERIAL	0.52	MAINTAIN
12N59	SLAB CREEK	2	BST - BITUMINOUS SURFACE TREATMENT	5.09	MAINTAIN
12N64	SAND MOUNTAIN BLVD	4	BST - BITUMINOUS SURFACE TREATMENT	4.89	MAINTAIN
12NY23	HIGH TENSION SPUR	1	NAT - NATIVE MATERIAL	1.30	MAINTAIN
12NY27	SADDLE BRUSH	2	NAT - NATIVE MATERIAL	0.52	MAINTAIN
12NY27A	SIDE SADDLE	2	NAT - NATIVE MATERIAL	1.03	MAINTAIN
13N10	NEVADA POINT WEST	2	NAT - NATIVE MATERIAL	1.46	MAINTAIN
13N10	NEVADA POINT WEST	2	NAT - NATIVE MATERIAL	0.25	MAINTAIN
13N39	MCCULLOH RIDGE	2	NAT - NATIVE MATERIAL	3.66	MAINTAIN
13N39A	UPPER BELIX	2	NAT - NATIVE MATERIAL	0.85	MAINTAIN
13N39B	CLEAR CUT SPUR	2	NAT - NATIVE MATERIAL	0.25	MAINTAIN
13N40	ELLICOTT	2	NAT - NATIVE MATERIAL	0.25	MAINTAIN
13N42	UPPER ROOST CANYON	2	BST - BITUMINOUS SURFACE TREATMENT	1.45	MAINTAIN
13N42	UPPER ROOST CANYON	2	BST - BITUMINOUS SURFACE TREATMENT	1.16	MAINTAIN
13N67	BIG GRIZZLY CANYON	1	NAT - NATIVE MATERIAL	0.66	MAINTAIN
13N68	DEVIL GRIZZLY TIE	2	NAT - NATIVE MATERIAL	0.41	MAINTAIN
13N73	BIG GRIZZLY CAN NO SPUR	2	NAT - NATIVE MATERIAL	0.55	MAINTAIN
13N74	DEVIL PEAK	2	NAT - NATIVE MATERIAL	1.90	MAINTAIN
13N74	DEVIL PEAK	2	NAT - NATIVE MATERIAL	0.29	MAINTAIN
14N08	ELEVEN PINES	3	BST - BITUMINOUS SURFACE TREATMENT	20.90	MAINTAIN
14N08C	PIGEON FLAT	2	NAT - NATIVE MATERIAL	1.45	MAINTAIN
14N08E	BELIX SPRING	2	NAT - NATIVE MATERIAL	1.70	MAINTAIN
14N08F	BELIX TRAIL	1	NAT - NATIVE MATERIAL	1.21	MAINTAIN
14N08L	MCCULLOH PINES	1	NAT - NATIVE MATERIAL	0.38	MAINTAIN
14N10	NEVADA POINT RIDGE	2	BST - BITUMINOUS SURFACE TREATMENT	7.27	MAINTAIN
14N10C	NE BEAR SPRINGS	2	NAT - NATIVE MATERIAL	1.01	MAINTAIN
14N10E	EAST LITTLE WALLACE CAN	1	NAT - NATIVE MATERIAL	0.45	MAINTAIN
14N10G	WALLACE EAST	2	NAT - NATIVE MATERIAL	0.66	MAINTAIN

RD_NO	NAME	MTCE. LEVEL	SURFACING	EST. MILES	TREATMENT
14N11	PARSLEY BAR	1	NAT - NATIVE MATERIAL	3.57	MAINTAIN
14N11A		1	NAT - NATIVE MATERIAL	0.54	MAINTAIN
14N11D	NEVADA PARSLEY	1	NAT - NATIVE MATERIAL	0.22	MAINTAIN
14N11E	SLUMPY	1	NAT - NATIVE MATERIAL	0.64	MAINTAIN
14N12	LONG JOHN CREEK	2	NAT - NATIVE MATERIAL	2.00	MAINTAIN
14N12C	NORTH WALLACE	2	NAT - NATIVE MATERIAL	0.21	MAINTAIN
14N19	DESERT COLD SPRINGS	2	NAT - NATIVE MATERIAL	1.16	MAINTAIN
14N19	DESERT COLD SPRINGS	2	NAT - NATIVE MATERIAL	3.23	MAINTAIN
14N19B	DESERT COLD SPRING SOUTH	1	NAT - NATIVE MATERIAL	0.59	MAINTAIN
14N20	FALLION MILL	3	NAT - NATIVE MATERIAL	4.26	MAINTAIN
14N20B	NEVADA SPUR	2	NAT - NATIVE MATERIAL	0.69	MAINTAIN
14N20D		2	NAT - NATIVE MATERIAL	0.36	MAINTAIN
14N43	BIG MEADOW CG	3	BST - BITUMINOUS SURFACE TREATMENT	0.80	MAINTAIN
14N53	WALLACE CANYON	1	NAT - NATIVE MATERIAL	1.34	MAINTAIN
17N02	OLD ICE HOUSE	4	BST - BITUMINOUS SURFACE TREATMENT	7.82	MAINTAIN
SUBTOTAL MAINTENANCE				**168.88**	
11N12A	POHO HO	2	NAT - NATIVE MATERIAL	0.56	REPAIR
11N12A	POHO HO	2	NAT - NATIVE MATERIAL	0.26	REPAIR
11N35	VLECK CREEK	2	NAT - NATIVE MATERIAL	0.37	REPAIR
11N54	BEND	2	NAT - NATIVE MATERIAL	1.43	REPAIR
11N54A	BEND SPUR	2	NAT - NATIVE MATERIAL	0.21	REPAIR
11N54B	BEND OVER	2	NAT - NATIVE MATERIAL	0.63	REPAIR
11N55	PEAVINE RIDGE	2	NAT - NATIVE MATERIAL	1.22	REPAIR
11N55	PEAVINE RIDGE	2	NAT - NATIVE MATERIAL	2.76	REPAIR
11N55E	BROCK	2	NAT - NATIVE MATERIAL	0.18	REPAIR
11N56	JAYBIRD CANYON	2	NAT - NATIVE MATERIAL	1.16	REPAIR
11N56	JAYBIRD CANYON	2	NAT - NATIVE MATERIAL	1.96	REPAIR
11N56A	SIDE CANYON	1	NAT - NATIVE MATERIAL	3.83	REPAIR
11N57B	ROUND TUIT	1	NAT - NATIVE MATERIAL	0.28	REPAIR
11N60B	JAYBIRD NORTH	2	NAT - NATIVE MATERIAL	0.25	REPAIR
11N60BA	JAYBIRD NORTH 1	1	NAT - NATIVE MATERIAL	0.21	REPAIR
11N60BC	JAYBIRD NORTH 2	1	NAT - NATIVE MATERIAL	0.17	REPAIR
11N60BD		2	NAT - NATIVE MATERIAL	0.13	REPAIR
11N60BE		2	NAT - NATIVE MATERIAL	0.23	REPAIR
11N60D	JAYBIRD VALVE HOUSE	2	NAT - NATIVE MATERIAL	0.83	REPAIR
11N60DB		2	NAT - NATIVE MATERIAL	0.18	REPAIR
11N60DC	JAYBIRD VALVE HOUSE SPUR	2	NAT - NATIVE MATERIAL	0.38	REPAIR
11N60DD		2	NAT - NATIVE MATERIAL	0.04	REPAIR
11N60E	JADE EAST	1	NAT - NATIVE MATERIAL	0.08	REPAIR
11N60G	JAY GEE	1	NAT - NATIVE MATERIAL	0.64	REPAIR
11N60GA	JAY GEE A	1	NAT - NATIVE MATERIAL	0.10	REPAIR
11N60H	JAYBIRD H	1	NAT - NATIVE MATERIAL	0.27	REPAIR
11N60HA	JAYBIRD HA	1	NAT - NATIVE MATERIAL	0.57	REPAIR
11N63	WEST PEAVINE RIDGE	2	NAT - NATIVE MATERIAL	10.18	REPAIR
11N63A	SPRING VALLEY	2	NAT - NATIVE MATERIAL	0.70	REPAIR

RD_NO	NAME	MTCE. LEVEL	SURFACING	EST. MILES	TREATMENT
11N63C	NORTH ALLEN	1	NAT - NATIVE MATERIAL	0.27	REPAIR
11N63F	SILVER PEA	2	NAT - NATIVE MATERIAL	0.63	REPAIR
11N64E	ROUND TENT SPUR	2	NAT - NATIVE MATERIAL	0.18	REPAIR
11N64F	ROUND TENT WEST	1	NAT - NATIVE MATERIAL	0.41	REPAIR
11N69	POWERLINE RIM	2	NAT - NATIVE MATERIAL	1.53	REPAIR
11N69A	POWERLINE RIM SPUR	2	NAT - NATIVE MATERIAL	0.52	REPAIR
11N70C	TELEPHONE EAST	2	NAT - NATIVE MATERIAL	2.53	REPAIR
11N70D	TELEPHONE SPUR	1	NAT - NATIVE MATERIAL	0.84	REPAIR
11N71	JAYBIRD CANYON SPRING	2	NAT - NATIVE MATERIAL	0.87	REPAIR
11N71A	SILVER CANYON VISTA	2	NAT - NATIVE MATERIAL	1.61	REPAIR
11N71B	SILVER CANYON EAST	2	NAT - NATIVE MATERIAL	0.44	REPAIR
11N72A	BACKHAUL SPUR	2	NAT - NATIVE MATERIAL	0.31	REPAIR
11N73	JAYBIRD SOUTH	2	NAT - NATIVE MATERIAL	2.22	REPAIR
11N76	INDIAN HATTIES	2	NAT - NATIVE MATERIAL	0.47	REPAIR
11N76	INDIAN HATTIES	2	NAT - NATIVE MATERIAL	0.22	REPAIR
11N77	JAYBIRD SPRING WEST	2	NAT - NATIVE MATERIAL	0.10	REPAIR
11N77A	JAYBIRD SPRING SOUTH	2	NAT - NATIVE MATERIAL	0.51	REPAIR
11N93	WINDING WAY	1	NAT - NATIVE MATERIAL	0.72	REPAIR
11NY20	GASPARNI	2	NAT - NATIVE MATERIAL	0.36	REPAIR
11NY22	X-RAY	1	NAT - NATIVE MATERIAL	0.13	REPAIR
11NY22AB		1	NAT - NATIVE MATERIAL	0.08	REPAIR
11NY25	RICE MCMANUS TIE	2	NAT - NATIVE MATERIAL	0.39	REPAIR
11NY25A	RICE RIDGE	2	NAT - NATIVE MATERIAL	1.08	REPAIR
12N19		2	NAT - NATIVE MATERIAL	1.07	REPAIR
12N29R	PITCH PINE	1	NAT - NATIVE MATERIAL	0.33	REPAIR
12N34G	FOREBAY SPUR	2	NAT - NATIVE MATERIAL	1.23	REPAIR
12N34KB		1	NAT - NATIVE MATERIAL	0.16	REPAIR
12N34P	34P	1	NAT - NATIVE MATERIAL	0.17	REPAIR
12N46	VAUGHN	2	NAT - NATIVE MATERIAL	0.44	REPAIR
12N47	ELEVEN PINES RIDGE	2	NAT - NATIVE MATERIAL	1.80	REPAIR
12N47A	DIGGER PINE	2	NAT - NATIVE MATERIAL	0.35	REPAIR
12N47B	JACK PINE	2	NAT - NATIVE MATERIAL	0.23	REPAIR
12N47C	JEFFREY PINE	1	NAT - NATIVE MATERIAL	0.49	REPAIR
12N53CA	53CA	1	NAT - NATIVE MATERIAL	0.36	REPAIR
12N54DA	54DA	2	NAT - NATIVE MATERIAL	0.16	REPAIR
12N54E	54E	1	NAT - NATIVE MATERIAL	0.37	REPAIR
12N56	BIG X MTN	2	NAT - NATIVE MATERIAL	3.46	REPAIR
12N56	BIG X MTN	2	NAT - NATIVE MATERIAL	0.31	REPAIR
12N56E	MANZANITA	2	NAT - NATIVE MATERIAL	0.33	REPAIR
12N56F	DUG FIR	2	NAT - NATIVE MATERIAL	0.43	REPAIR
12N57E	57E	2	NAT - NATIVE MATERIAL	0.39	REPAIR
12N58	CAMP SIX	2	NAT - NATIVE MATERIAL	0.31	REPAIR
13E05		1	NAT - NATIVE MATERIAL	0.38	REPAIR
13N39A	UPPER BELIX	2	NAT - NATIVE MATERIAL	1.14	REPAIR
13N39B	CLEAR CUT SPUR	2	NAT - NATIVE MATERIAL	1.41	REPAIR
13N40	ELLICOTT	2	NAT - NATIVE MATERIAL	0.59	REPAIR
13N42	UPPER ROOST CANYON	2	NAT - NATIVE MATERIAL	2.63	REPAIR

RD_NO	NAME	MTCE. LEVEL	SURFACING	EST. MILES	TREATMENT
13N42C	LITTLE PIGEON	1	NAT - NATIVE MATERIAL	0.30	REPAIR
13N42D	ROOST CANYON	2	NAT - NATIVE MATERIAL	0.83	REPAIR
13N42E	INDIAN ROCK	2	NAT - NATIVE MATERIAL	0.76	REPAIR
13N42H	ROOST SPUR	2	NAT - NATIVE MATERIAL	0.50	REPAIR
13N47	BACCHI RANCH BYPASS	1	NAT - NATIVE MATERIAL	0.60	REPAIR
13N73	BIG GRIZZLY CAN NO SPUR	2	NAT - NATIVE MATERIAL	0.93	REPAIR
13N73A	GRIZZLY TERRACE	1	NAT - NATIVE MATERIAL	0.70	REPAIR
13N91	MID SLOPE	2	NAT - NATIVE MATERIAL	0.89	REPAIR
13N91	MID SLOPE	2	NAT - NATIVE MATERIAL	0.83	REPAIR
13N91A	SET UP	2	NAT - NATIVE MATERIAL	0.43	REPAIR
13N94	DEVIL TOP	1	NAT - NATIVE MATERIAL	0.14	REPAIR
14N08D	LAZY J SPUR	2	NAT - NATIVE MATERIAL	0.54	REPAIR
14N08F	BELIX TRAIL	1	NAT - NATIVE MATERIAL	0.76	REPAIR
14N08G	VAUGHN CABIN	2	NAT - NATIVE MATERIAL	0.59	REPAIR
14N08M	RUBI	2	NAT - NATIVE MATERIAL	0.23	REPAIR
14N09	CHIPMUNK RIDGE	4	BST - BITUMINOUS SURFACE TREATMENT	2.26	REPAIR
14N10	NEVADA POINT RIDGE	2	NAT - NATIVE MATERIAL	1.64	REPAIR
14N10	NEVADA POINT RIDGE	2	NAT - NATIVE MATERIAL	1.84	REPAIR
14N10C	NE BEAR SPRINGS	2	NAT - NATIVE MATERIAL	0.57	REPAIR
14N10E	EAST LITTLE WALLACE CAN	1	NAT - NATIVE MATERIAL	2.11	REPAIR
14N10H	CANYON WALLACE	1	NAT - NATIVE MATERIAL	0.78	REPAIR
14N11	PARSLEY BAR	1	NAT - NATIVE MATERIAL	0.30	REPAIR
14N11B	HALES CROSSING	2	NAT - NATIVE MATERIAL	0.30	REPAIR
14N12	LONG JOHN CREEK	2	NAT - NATIVE MATERIAL	1.98	REPAIR
14N12	LONG JOHN CREEK	2	NAT - NATIVE MATERIAL	1.42	REPAIR
14N12A	LONG JOHNS	1	NAT - NATIVE MATERIAL	0.32	REPAIR
14N12B	LONG JOHN SPUR	1	NAT - NATIVE MATERIAL	0.52	REPAIR
14N17	SOUTH LOWER MEADOWS	2	NAT - NATIVE MATERIAL	1.12	REPAIR
14N17A	GRANITE TUNNEL EAST	2	NAT - NATIVE MATERIAL	1.00	REPAIR
14N20A	FALLION SPUR	2	NAT - NATIVE MATERIAL	0.49	REPAIR
14N20C		2	NAT - NATIVE MATERIAL	0.13	REPAIR
14N53A		1	NAT - NATIVE MATERIAL	0.19	REPAIR
17N02G		2	NAT - NATIVE MATERIAL	0.36	REPAIR
NS-1		1	NAT - NATIVE MATERIAL	0.18	REPAIR
SUBTOTAL REPAIR				**91.33**	
TOTAL MILES OF ROADS				**259.57**	

APPENDIX D: UNIT TREATMENTS

TABLE LEGEND

Conifer Resilience	CR	Plant/Release	P/Rel
Strategic Fire Management Zone	SFMZ	Release of Planted Seedlings	Rel
Wildland Urban Intermix	WUI	Hand Thin and Hand Pile Small Material	HT/HP
Roadside	RD	Watershed Improvement Treatments	WS
Strategically Placed Landscape Treatment	SPLAT	Natural Recovery	NRec
Forest Resilience with Variable Snag Retention Study	VSS	Natural Regeneration	NReg
Variable SAL and Planting Study and WSA	Var/PL	SFMZ Reforestation	SFMZ/Ref
Watershed Sensitive Area	WSA	Mid to Upper Slope Reforestation Area	M-U/Ref
Resource Benefit	RB	Upper Slope Reforestation Area	U/Ref
Long Term Soil Productivity Study	LTSP	Mid to Lower Slope Reforestation Area	M-L/Ref
Control for Monitoring by the Regional Water Board	CVRWB	Lower Slope Reforestation Area	L/Ref
Prescribe Fire	PF	Mid Slope Reforestation Area	M/Ref
Roadside Salvage	RDSAL	Upper Slope Hardwood/Pine Reforestation Area	UHW/P/Ref
Mechanical Harvest	MH	Glyphosate or Hand Grub	Gly/HG
Hazard Tree Felling and Hand Piling of Small Material	HZ/HP	Survey 1st	SURV
Skyline Harvest	SH	Hardwood/Pine	HW/P
Masticate or Pile	M/P	Post Monitoring Gly/HG	Mon Gly/HG

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
0	Other		PF	NRec		PF	2,058	2,085	1,997
0	RD		RDSAL	NRec		PF	-	-	67
1	CR		MH	M-U/Ref		Gly/HG	214	214	214
2	CR		MH	U/Ref	SURV	Gly/HG	67	-	67
3	CR	CR with VSS	MH	M-U/Ref		Gly/HG	355	355	355
4	CR	WSA	MH	M-U/Ref		Gly/HG	5	5	5
5	SFMZ		MH	SFMZ/Ref		Gly/HG	21	21	21
21	Other	RB	HZ/HP	NRec		None	6	6	5
21	RD		RDSAL	NRec		None	-	-	1
22	Other	RB	HZ/HP	NRec		None	7	7	6
22	RD		RDSAL	NRec		None	-	-	1
23	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	29	-	29
24	CR		MH	M-L/Ref		Gly/HG	4	4	4
24	CR		SH	M-L/Ref		Gly/HG	13	12	13

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
25	SFMZ		MH	NReg		None	39	21	39
26	SFMZ		MH	NReg		None	6	4	6
27	WSA	WSA	MH	NRec		None	5	5	5
28	WSA	WSA	MH	NRec		None	5	5	5
30	WSA	WSA	MH	NRec		None	7	7	7
33	CR		MH	M-L/Ref	SURV	Gly/HG	30	-	30
34	CR		MH	M-L/Ref	SURV	Gly/HG	85	-	85
35	CR		MH	M-L/Ref	SURV	Gly/HG	42	-	42
37	CR		SH	Upper to L/Ref		Gly/HG	85	85	85
40	SFMZ		MH	SFMZ/Ref		Gly/HG	9	9	9
42	CR		MH	L/Ref		Gly/HG	3	3	3
43	CR		MH	M-L/Ref		Gly/HG	14	14	14
44	SFMZ		MH	NReg		None	69	43	69
45	CR		MH	M/Ref	SURV	Gly/HG	48	-	48
46	SFMZ		MH	NReg		None	41	31	41
47	SFMZ		MH	NReg		Gly/HG	82	51	82
48	SFMZ		MH	NReg		None	18	7	18
49	SFMZ		MH	NReg		None	78	20	78
50	SFMZ		MH	SFMZ/Ref		Gly/HG	157	112	157
51	CR		MH	M/Ref		Gly/HG	9	9	9
52	CR		MH	M-L/Ref		Gly/HG	35	35	35
53	SFMZ		MH	SFMZ/Ref		Gly/HG	5	5	5
54	SFMZ		MH	SFMZ/Ref		Gly/HG	5	2	5
55	SFMZ		MH	SFMZ/Ref		Gly/HG	3	2	3
56	SFMZ		MH	SFMZ/Ref		Gly/HG	14	14	14
57	SFMZ		MH	SFMZ/Ref		Gly/HG	1	1	1
58	SFMZ		MH	SFMZ/Ref		Gly/HG	14	13	14
61	SFMZ	RB	HZ/HP	NRec		None	6	-	6
62	Other	RB	HZ/HP	NRec		None	3	-	2
62	RD		RDSAL	NRec		None	-	-	1
63	SFMZ	RB	HZ/HP	NRec		None	6	-	4
65	Other	RB	HZ/HP	NRec		None	2	-	1
65	RD		RDSAL				-	-	1
66	SFMZ	RB	HZ/HP	NRec		None	6	6	2
66	RD		RDSAL	NRec		None	-	-	4
67	Other	RB	HZ/HP	NRec		None	3	-	3
70	SFMZ	RB	HZ/HP	NRec		None	2	2	2
71	Other	RB	HZ/HP	NRec		None	3	-	-
71	RD		RDSAL	NRec		None	-	-	3

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy	Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
72	Other	RB	HZ/HP	NRec	None	3	-	1
72	Other		RDSAL	NRec	None	-	-	2
73	Other	RB	HZ/HP	NRec	None	3	-	3
74	Other	RB	HZ/HP	NRec	None	2	-	1
74	RD		RDSAL	NRec	None	-	-	1
75	Other	RB	HZ/HP	NRec	None	2	-	1
75	RD		RDSAL	NRec	None	-	-	1
81	CR		SH	NReg	None	34	34	57
82	SFMZ		MH	NReg	None	12	12	12
83	SFMZ		MH	NReg	None	29	29	29
100	SFMZ		MH	SFMZ/Ref	Gly/HG	85	85	85
101	CR		MH	M/Ref	Gly/HG	180	180	180
104	SFMZ		MH	NReg	PF	18	18	18
200	CR		MH	M/Ref	Gly/HG	118	118	118
201	SFMZ		MH	SFMZ/Ref	Gly/HG	41	41	41
202	SFMZ		MH	SFMZ/Ref	Gly/HG	24	24	24
203	CR	CR with VSS	MH	M/Ref	Gly/HG	239	239	239
204	CR	CR with VSS	MH	M/Ref	Gly/HG	105	105	105
205	SFMZ		MH	SFMZ/Ref	Gly/HG	371	371	371
206	CR		MH	M-L/Ref	Gly/HG and BF	51	51	39
206	RD		RDSAL	M-L/Ref	Gly/HG and BF	-	-	12
207	CR		MH	U/Ref	Gly/HG and BF	6	6	3
207	RD		RDSAL	U/Ref	Gly/HG and BF	-	-	3
208	CR		SH	U/Ref	Gly/HG and BF	22	22	18
208	RD		RDSAL	U/Ref	Gly/HG and BF	-	-	4
301	CR		MH	M/Ref	Gly/HG	194	-	194
302	CR		MH	M/Ref	Gly/HG	27	27	27
303	CR		MH	NReg	Gly/HG	15	15	15
304	CR	WSA	MH	M-L/Ref	Gly/HG	42	42	42
306	CR	Var/PL	MH	M/Ref	Gly/HG	130	130	130
307	CR		MH	M/Ref	Gly/HG	20	20	20
308	CR	CR with VSS	MH	M/Ref	Gly/HG	101	101	101
309	CR		MH	M/Ref	Gly/HG	107	-	107
310	CR	Var/PL	MH	M/Ref	Gly/HG	111	111	111
311	CR		MH	M/Ref	Gly/HG	4	-	4

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
312	SFMZ		MH	SFMZ/Ref		Gly/HG	111	111	111
313	CR		M/P	M/Ref		Gly/HG	3	3	3
314	SFMZ		M/P	SFMZ/Ref		Gly/HG	7	7	7
315	SFMZ		M/P	SFMZ/Ref		Gly/HG	4	4	4
316	SFMZ		M/P	SFMZ/Ref		Gly/HG	3	3	3
317	SFMZ		MH	SFMZ/Ref		Gly/HG	18	18	18
318	SFMZ		MH	SFMZ/Ref		Gly/HG	12	12	12
319	SFMZ		M/P	SFMZ/Ref		Gly/HG	3	3	3
320	SFMZ		MH	SFMZ/Ref		Gly/HG	18	18	18
321	SFMZ		MH	SFMZ/Ref		Gly/HG	6	6	6
323	SFMZ		MH	SFMZ/Ref		Gly/HG	59	59	59
324	CR		M/P	M/Ref		Gly/HG	2	324	2
325	SFMZ		MH	SFMZ/Ref		Gly/HG	11	11	11
326	SFMZ		MH	SFMZ/Ref		Gly/HG and BF	36	36	21
327	SFMZ		MH	SFMZ/Ref		Gly/HG and BF	18	18	18
330	HW/P		MH	UHW/P/Ref		Gly/HG	43	43	43
331	HW/P		MH	UHW/P/Ref		Gly/HG	20	20	20
332	SFMZ		MH	SFMZ/Ref		Gly/HG	69	69	69
333	SFMZ		MH	SFMZ/Ref		Gly/HG	107	107	107
403	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	21	21	21
404	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	4	4	4
450	CR		MH	U/Ref		Gly/HG	19	19	19
451	CR		MH	U/Ref		Gly/HG	19	19	19
452	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	16	15	16
453	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	15	14	15
501	SFMZ		P/Rel	SFMZ/Ref		Gly/HG	7	7	7
502	CR		P/Rel	M/Ref		Gly/HG	5	5	5
503	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	63	63	63
504	SFMZ	WSA	P/Rel	SFMZ/Ref		Gly/HG	39	39	39
509	CR		Rel	M/Ref		Gly/HG	14	14	14
510	CR	CR with VSS	MH	M/Ref		Gly/HG	97	97	97
511	CR		SH	M-L/Ref		Gly/HG	67	-	67
512	CR		MH	M/Ref		Gly/HG	14	14	14
514	CR		MH	M/Ref		Gly/HG	8	8	8
515	CR	Var/PL WSA	MH	M/Ref		Gly/HG	271	271	271
516	CR	LTSP	Rel	8x8		Gly/HG	10	10	10
518	SFMZ		MH	SFMZ/Ref		Gly/HG	161	161	161
522	CR		MH	L/Ref		Gly/HG	4	4	4

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
523	CR		MH	M-L/Ref		Gly/HG	13	13	13
524	CR		MH	M/Ref		Gly/HG	3	3	3
525	CR		MH	M/Ref		Gly/HG	24	24	24
526	CR		MH	M-L/Ref		Gly/HG	11	11	11
527	CR		MH	M/Ref		Gly/HG	7	7	7
528	CR	LTSP	Rel	8x8		Gly/HG	8	8	8
529	CR	LTSP	Rel	8x8		Gly/HG	9	9	9
530	CR		MH	M/Ref		Gly/HG	9	9	9
531	CR		MH	M/Ref		Gly/HG	11	11	11
532	CR	Var/PL	MH	M-L/Ref	SURV	Gly/HG	57	57	57
533	CR		MH	M/Ref		Gly/HG	3	-	3
535	CR		MH	M/Ref		Gly/HG	12	12	12
537	CR		MH	M/Ref		Gly/HG	29	29	29
539	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	44	31	44
540	CR	CR with VSS	MH	M-U/Ref	SURV	Gly/HG	96	96	96
541	CR	WSA	MH	M-U/Ref		Gly/HG	20	20	20
542	SFMZ		MH	SFMZ/Ref		Gly/HG	2	2	2
543	CR		MH	U/Ref		Gly/HG	2	2	2
547	SFMZ	Var/PL	MH	SFMZ/Ref		Gly/HG	49	49	49
554	CR		MH	M/Ref		Gly/HG	6	6	6
555	CR		MH	M/Ref		Gly/HG	4	4	4
556	CR	WSA	MH	M-L/Ref		Gly/HG	24	23	24
557	CR		MH	M/Ref		Gly/HG	24	24	24
559	CR	WSA	MH	M/Ref		Gly/HG	9	9	9
561	CR	CR with VSS	MH	M-U/Ref	SURV	Gly/HG	40	40	40
562	CR	CR with VSS	MH	M/Ref		Gly/HG	44	44	44
563	CR	CR with VSS	MH	M-L/Ref	SURV	Gly/HG	62	62	62
654	CR		MH	M-L/Ref	SURV	Gly/HG	7	7	7
565	CR		MH	M/Ref		Gly/HG	28	28	28
566	CR	WSA	MH	Upper to L/Ref		Gly/HG	73	73	73
567	CR	WSA	MH	M/Ref		Gly/HG	18	18	18
568	CR	Var/PL WSA	MH	M-U/Ref		Gly/HG	77	77	77
601	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	18	18	18
603	SFMZ	WSA	WS	SFMZ/Ref	SURV	Gly/HG	16	16	16
606	Other	RB	HZ/HP	NRec		None	103	103	103
607	CR		M/P	M/Ref		Gly/HG	22	22	22
608	CR		M/P	M-U/Ref		Gly/HG	16	16	16

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy	Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
609	CR		M/P	M-U/Ref	Gly/HG	6	6	6
610	CR		M/P	M/Ref	Gly/HG	10	10	10
611	CR		MH	M-U/Ref	Gly/HG	17	17	17
612	CR		M/P	M/Ref	Gly/HG	25	25	25
613	CR		MH	M/Ref	Gly/HG	4	4	4
614	CR		M/P	M/Ref	Gly/HG	7	7	7
615	SFMZ		MH	SFMZ/Ref	Gly/HG	22	22	22
616	CR		P/Rel	M/Ref	Gly/HG	5	5	5
617	SFMZ		M/P	SFMZ/Ref	Gly/HG	18	18	18
618	SFMZ		MH	SFMZ/Ref	Gly/HG	17	17	17
619	SFMZ		MH	SFMZ/Ref	Gly/HG	14	14	14
620	SFMZ		P/Rel	SFMZ/Ref	Gly/HG	2	2	2
621	SFMZ		P/Rel	SFMZ/Ref	Gly/HG	10	10	10
622	SFMZ		MH	SFMZ/Ref	Gly/HG	3	3	3
623	CR		P/Rel	M/Ref	Gly/HG	9	9	9
624	SFMZ		P/Rel	SFMZ/Ref	Gly/HG	3	3	3
625	CR		MH	M/Ref	Gly/HG	6	-	6
626	CR	WSA	MH	M-U/Ref	Gly/HG and BF	89	89	77
626	RD		RDSAL	M-U/Ref	Gly/HG and BF	-	-	12
627	CR		M/P	M-U/Ref	Gly/HG and BF	5	5	5
629	CR	WSA	P/Rel	M-U/Ref	Gly/HG	5	5	5
630	CR		M/P	M-U/Ref	Gly/HG	10	10	10
631	CR	WSA	MH	M-U/Ref	Gly/HG	33	17	33
632	CR		MH	M-U/Ref	Gly/HG	36	-	36
633	CR		Rel	M-U/Ref	Gly/HG and BF	188	188	170
633	CR		RDSAL	M-U/Ref	Gly/HG	-	-	11
634	SFMZ		MH	SFMZ/Ref	Gly/HG	16	16	16
635	CR		P/Rel	M/Ref	Gly/HG	7	7	7
636	CR		P/Rel	M/Ref	Gly/HG	11	11	11
637	CR		P/Rel	M/Ref	Gly/HG	13	13	13
640	SFMZ		M/P	SFMZ/Ref	Gly/HG	2	2	2
641	CR		M/P	M/Ref	Gly/HG and BF	6	6	6
642	CR		P/Rel	M/Ref	Gly/HG	14	14	14
643	CR		P/Rel	M/Ref	Gly/HG	18	18	18
644	CR		P/Rel	M/Ref	Gly/HG	25	25	25
645	SFMZ		M/P	SFMZ/Ref	Gly/HG	4	4	4
646	CR		M/P	M/Ref	Gly/HG	10	10	10

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
647	CR		M/P	M/Ref		Gly/HG	10	10	10
648	CR		M/P	M/Ref		Gly/HG	4	4	4
649	SFMZ		P/Rel	SFMZ/Ref		Gly/HG	19	19	19
651	CR		M/P	M-L/Ref		Gly/HG	8	8	8
652	CR		M/P	M-L/Ref		Gly/HG and BF	11	11	11
653	CR		M/P	M-L/Ref		Gly/HG and BF	4	4	4
654	CR		M/P	M-U/Ref		Gly/HG and BF	16	15	16
657	CR		M/P	M-U/Ref		Gly/HG and BF	5	5	5
660	SFMZ		HT/HP	NRec		PF	114	116	114
661	Other		HZ/HP	NRec		PF	1	1	1
662	SFMZ		SH	SFMZ/Ref		Gly/HG and BF	8	8	8
663	CR		MH	M/Ref		Gly/HG and BF	38	38	38
665	SFMZ		HT/HP	SFMZ/Ref		Gly/HG and BF	44	44	37
665	SFMZ		RDSAL	SFMZ/Ref		Gly/HG and BF	-	-	7
666	SFMZ		MH	SFMZ/Ref		Gly/HG and BF	71	71	71
667	Other		MH	NReg		PF	28	-	26
667	RD		RDSAL	NReg		PF	-	-	2
668	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	191	191	191
669	SFMZ		MH	SFMZ/Ref		Gly/HG	101	101	101
673	SFMZ		P/Rel	SFMZ/Ref		Gly/HG	19	19	19
674	SFMZ		HT/HP	NRec		PF	15	15	15
675	SFMZ		MH	NReg		PF	304	303	256
676	CR	WSA	MH	M/Ref		Hand Grub	16	16	16
677		WSA	WS	NRec		None	35	35	35
679	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	161	147	161
680	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	43	34	43
681	CR		MH	Upper to L/Ref		Gly/HG	415	249	415
682	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	7	4	7
683	SFMZ		MH	SFMZ/Ref		Gly/HG	27	1	27
684	SFMZ		MH	SFMZ/Ref		Gly/HG	8	8	8
685	SFMZ		MH	SFMZ/Ref		Gly/HG	84	56	84
687	SFMZ		MH	SFMZ/Ref		Gly/HG	32	32	32
688	SFMZ		MH	SFMZ/Ref		Gly/HG	9	1	9
689	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	32	32	32
690	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	8	2	8

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
692	SFMZ		MH	NReg		None	8	3	8
693	SFMZ		MH	SFMZ/Ref		Gly/HG	2	2	2
694	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	8	8	8
695	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	21	20	21
696	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	7	-	7
697	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	2	2	2
699	CR		MH	M/Ref		Gly/HG	10	10	10
700	CR		M/P	M/Ref		Gly/HG	23	-	23
701	CR		M/P	M/Ref		Gly/HG	10	10	10
702	CR		M/P	M-U/Ref		Gly/HG	9	8	8
703	CR		M/P	M-L/Ref		Gly/HG	28	4	28
704	CR		M/P	M-U/Ref		Gly/HG	14	3	14
705	CR		MH	M-L/Ref		Gly/HG	5	4	5
706	CR		MH	M-U/Ref		Gly/HG	15	-	15
707	CR		M/P	M/Ref		Gly/HG	7	-	7
708	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	14	14	14
709	CR		M/P	M/Ref		Gly/HG	5	5	5
710	CR		M/P	M-U/Ref		Gly/HG	6	6	6
711	CR		M/P	M-U/Ref		Gly/HG	11	11	11
712	SFMZ		M/P	SFMZ/Ref		Gly/HG	1	1	1
713	SFMZ		M/P	SFMZ/Ref		Gly/HG	4	4	4
714	CR		M/P	M/Ref		Gly/HG	15	15	15
716	CR		M/P	M/Ref		Gly/HG	13	13	13
717	CR		M/P	M/Ref		Gly/HG	10	10	10
719	CR		MH	U/Ref		Gly/HG	6	5	6
722	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	15	13	13
723	SFMZ		M/P	SFMZ/Ref		Gly/HG	25	25	25
724	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	8	8	8
725	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	26	26	26
727	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	22	10	22
728	Other		HZ/HP	NRec		None	3	3	-
729	HW/P	RB	HZ/HP	UHW/P/Ref		Gly/HG	7	7	6
729	RD		RDSAL	UHW/P/Ref		Gly/HG	-	-	1
733	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	30	22	30
734	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	67	67	67
735	SFMZ		MH	SFMZ/Ref		Gly/HG	46	19	46
736	CR		MH	M/Ref		Gly/HG	34	-	36
737	SFMZ		MH	NRec		None	220	164	220
738	SFMZ		MH	SFMZ/Ref	Portion s SURV	Gly/HG	122	54	122

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
739	SFMZ		MH	SFMZ/Ref		Gly/HG	7	6	7
740	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	53	34	53
741	SFMZ		MH	NRec		None	1	1	1
742	SFMZ		MH	NRec		None	3	-	3
743	SFMZ		MH	NRec		None	1	1	1
744	SFMZ		MH	SFMZ/Ref		Gly/HG	3	3	3
745	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	31	18	31
746	SFMZ		MH	SFMZ/Ref		Gly/HG	10	8	10
747	SFMZ		MH	NRec		None	20	18	20
748	SFMZ		MH	NRec		None	<1	-	-
749	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	9	6	9
750	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	9	-	9
751	SFMZ		MH	NRec		None	11	9	11
752	SFMZ	CVRWB	MH	SFMZ/Ref		Mon Gly/HG	49	33	49
753	SFMZ	CVRWB	SH	SFMZ/Ref	SURV	Mon Gly/HG	11	-	11
754	SFMZ	CVRWB	MH	SFMZ/Ref	SURV	Mon Gly/HG	83	35	83
756	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	38	11	38
757	SFMZ		MH	NReg		None	9	8	9
758	SFMZ		MH	NReg		None	2	2	1
759	SFMZ		MH	NReg		None	1	1	1
760	SFMZ		MH	NReg		None	3	3	3
761	SFMZ		MH	NReg		None	4	4	4
762	SFMZ		MH	NReg		None	7	7	7
763	SFMZ		MH	NReg		None	2	2	2
764	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	30	10	30
765	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	60	33	60
766	SFMZ		MH	NReg		None	17	15	17
767	SFMZ		MH	NReg		None	21	13	21
768	SFMZ		MH	NReg		None	14	9	14
769	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	4	4	4
770	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	9	5	9
772	SFMZ		MH	NReg		None	20	19	20
773	SFMZ		MH	NReg		None	13	9	13
774	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	42	18	42
775	SFMZ		MH	NReg		None	6	5	6
776	SFMZ		MH	NReg		None	1	1	1
777	SFMZ		MH	NReg		None	29	27	29
778	SFMZ		MH	NReg		None	82	54	82

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
779	SFMZ		MH	NReg		None	39	34	38
781	SFMZ		HT/HP	NRec		None	50	-	46
781	RD		RDSAL	NRec		None	-	-	4
782	SFMZ		HT/HP	NRec		None	105	-	90
782	SFMZ		RDSAL	NRec		None	-	-	15
783	SFMZ		HT/HP	NRec		None	106	-	69
783	SFMZ		RDSAL	NRec		None	-	-	38
784	SFMZ		HT/HP	NRec		None	88	15	78
784	SFMZ		RDSAL	NRec		None	-	-	11
785	SFMZ		HT/HP	NRec		None	60	58	7
785	SFMZ		RDSAL	NRec		None	-	-	53
786	SFMZ		HT/HP	NRec		PF	22	22	19
786	SFMZ		RDSAL	NRec		PF	-	-	3
787	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	24	22	24
788	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	21	17	21
789	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	11	11	11
790	SFMZ		MH	NRec		None	5	3	5
791	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	54	49	54
793	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	72	15	72
794	SFMZ		MH	NReg		None	81	45	81
795	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	372	180	372
796	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	22	6	22
797	WUI		MH	SFMZ/Ref	SURV	Gly/HG	37	37	37
798	WUI		MH	SFMZ/Ref	SURV	Gly/HG	22	22	22
799	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	7	-	7
800	SFMZ		MH	NReg		None	8	8	8
801	SFMZ		MH	NReg		None	4	4	4
802	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	5	4	5
803	SFMZ		MH	NReg		None	28	26	28
804	SFMZ		MH	SFMZ/Ref		Gly/HG	6	-	-
805	SFMZ		MH	SFMZ/Ref		Gly/HG	7	7	7
806	WUI		M/P and HZ	SFMZ/Ref		Gly/HG	49	49	49
807	WUI		HT/HP	NRec		None	58	58	58
808	WUI		HT/HP	NRec		None	10	10	10
809	WUI		MH	SFMZ/Ref	SURV	Gly/HG	34	34	34
810	WUI		MH	NReg		None	16	16	16
811	SFMZ		HT/HP	NRec		None	26	-	26
812	WUI		M/P and HZ	SFMZ/Ref		Gly/HG	15	15	15
813	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	13	11	13

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
814	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	9	9	9
815	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	5	3	5
816	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	13	11	13
817	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	7	7	7
818	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	13	12	13
820	SFMZ		MH	NReg		None	3	3	3
821	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	13	-	13
822	SFMZ		MH	SFMZ/Ref		Gly/HG	2	-	2
823	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	4	1	4
824	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	28	4	28
825	SFMZ		MH	NReg		None	7	7	7
826	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	107	58	107
827	WUI		M/P and HZ	NRec		None	208	208	208
828	SFMZ		M/P	NRec		None	4	3	4
829	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	2	2	2
830	SFMZ		M/P	NRec		None	19	1	19
831	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	3	3	3
832	SFMZ	CVRWB	M/P	NRec		None	8	7	8
833	SFMZ		M/P	NRec		None	4	3	4
834	SFMZ		M/P	NRec		None	14	2	14
835	SFMZ		M/P	NRec		None	13	11	13
836	SFMZ		M/P	SFMZ/Ref		Gly/HG	4	4	4
837	SFMZ		M/P	NRec		None	5	4	5
838	SFMZ		M/P	NRec		None	11	11	11
839	WUI		M/P	NRec		None	7	7	7
842	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	5	4	5
844	CR		M/P	M-L/Ref	SURV	Gly/HG	8	-	8
845	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	11	7	11
846	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	23	3	23
847	CR		M/P	M-L/Ref	SURV	Gly/HG	6	-	6
848	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	9	6	9
849	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	16	-	16
850	SFMZ		M/P	NRec		None	12	8	12
851	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	27	13	27
852	WUI		MH	NReg		None	46	46	46
853	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	25	19	25
856	CR		M/P	U/Ref	SURV	Gly/HG	16	-	16
857	SFMZ	CVRWB	M/P	SFMZ/Ref	SURV	Mon Gly/HG	17	11	17

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
858	SFMZ	CVRWB	M/P	SFMZ/Ref	SURV	Mon Gly/HG	13	9	13
859	SFMZ		M/P	NRec		None	23	20	23
860	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	12	10	12
861	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	15	3	15
862	CR		M/P	M-L/Ref	SURV	Gly/HG	8	-	9
867	CR		M/P	U/Ref	SURV	Gly/HG	4	-	4
868	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	32	24	32
870	SFMZ	WSA	M/P	SFMZ/Ref		Gly/HG	21	12	21
871	WUI		M/P	SFMZ/Ref	SURV	Gly/HG	4	4	4
872	WUI		M/P	SFMZ/Ref	SURV	Gly/HG	4	4	4
873	WUI		M/P	SFMZ/Ref	SURV	Gly/HG	17	16	16
874	SFMZ		P/Rel	SFMZ/Ref	SURV	Gly/HG	8	5	8
876	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	13	-	13
877	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	31	-	31
878	CR	WSA	M/P	M-L/Ref	SURV	Gly/HG	23	4	23
879	SFMZ		M/P	SFMZ/Ref		Gly/HG	9	2	9
880	SFMZ		M/P	SFMZ/Ref		Gly/HG	11	3	11
881	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	6	-	6
882	CR		M/P	U/Ref	SURV	Gly/HG	6	-	6
883	SFMZ	WSA	M/P	SFMZ/Ref		Gly/HG	16	16	16
884	WUI		MH	SFMZ/Ref	SURV	Gly/HG	14	14	14
885	CR		P/Rel	M-U/Ref		Gly/HG	2	-	2
886	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	173	98	173
887	CR		M/P	M-L/Ref	SURV	Gly/HG	5	-	5
888	CR		M/P	M-L/Ref	SURV	Gly/HG	8	-	8
889	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	9	8	9
890	CR		M/P	M-L/Ref	SURV	Gly/HG	13	-	13
891	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	3	3	3
892	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	11	-	11
893	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	3	3	3
894	SFMZ		M/P	SFMZ/Ref		Gly/HG	16	14	16
895	SFMZ		M/P	SFMZ/Ref		Gly/HG	19	-	19
896	SFMZ		M/P	SFMZ/Ref		Gly/HG	24	2	24
897	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	11	4	11
898	SFMZ		M/P	SFMZ/Ref		Gly/HG	2	-	2
899	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	18	17	18
900	SFMZ		M/P	SFMZ/Ref		Gly/HG	4	1	4
901	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	6	6	6
902	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	8	3	8

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
903	SFMZ		P/Rel	SFMZ/Ref	SURV	Gly/HG	2	1	2
904	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	5	-	5
905	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	15	11	15
906	SFMZ		HZ/HP	SFMZ/Ref	SURV	Gly/HG	33	19	18
906	RD		RDSAL	SFMZ/Ref	SURV	Gly/HG	-	-	15
907	SFMZ		P/Rel	SFMZ/Ref	SURV	Gly/HG	1	1	1
908	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	7	7	7
910	SFMZ		MH	NReg		None	81	55	81
912	SFMZ		HZ/HP	NRec		None	66	59	25
912	SFMZ		RDSAL	NRec		None	-	-	41
914	CR	WSA	WS	L/Ref		Gly/HG	46	46	46
915	SFMZ	WSA	WS	SFMZ/Ref		Gly/HG	21	21	21
916	SFMZ	WSA	WS	SFMZ/Ref		Gly/HG	10	10	7
917	Other	WSA	WS	NRec		None	8	8	8
918	CR	WSA	WS	U/Ref		Gly/HG	16	16	16
919	Other	WSA	WS	NRec		None	20	20	20
924	WUI		HZ/HP	NRec		None	77	77	56
924	RD		RDSAL	NRec		None	-	-	21
925	WUI		M/P and HZ	NRec		None	192	192	192
926	WUI		HT/HP	NRec		None	5	5	5
927	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	74	39	74
928	SFMZ		MH	SFMZ/Ref		Gly/HG	90	53	90
929	SFMZ		MH	SFMZ/Ref		Gly/HG	2	2	2
932	SFMZ	WSA	WS	NRec		None	3	3	3
933	CR	WSA	WS			Gly/HG	43	43	43
935	WUI	WSA	HT/HP	NRec		None	152	152	124
935	WUI		RDSAL	NRec		None	-	-	27
936	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	248	163	248
937	SFMZ		MH	NReg		None	1	-	2
938	SFMZ		MH	NReg		None	3	-	3
939	SFMZ		MH	SFMZ/Ref		Gly/HG	16	-	16
941	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	76	47	76
942	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	46	29	46
943	SFMZ		MH	NReg		None	34	17	34
944	SFMZ		MH	NReg		None	44	28	44
945	SFMZ		MH	NReg		None	18	12	18
946	SFMZ		MH	NReg		None	59	32	59
947	SFMZ		MH	NReg		None	53	47	53
948	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	20	-	20

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
949	SFMZ		MH	NReg		None	25	5	25
950	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	100	49	100
951	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	2	2	2
953	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	130	62	130
954	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	59	15	59
955	Other	WSA	WS	NRec		None	20	20	20
956	Other		HZ/HP	NRec		None	5	5	4
956	RD		RDSAL	NRec		None	-	-	1
957	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	19	19	19
959	SFMZ		M/P and HZ	NRec		None	16		16
2026	CR		MH	U/Ref	SURV	Gly/HG	-	-	149
2027	CR		MH	U/Ref	SURV	Gly/HG	-	-	14
2028	CR		MH	M-U/Ref	SURV	Gly/HG	-	-	38
2029	CR		MH	U/Ref	SURV	Gly/HG	-	-	15
2030	SFMZ		MH	NReg		None	-	-	3
2031	SFMZ		MH	NReg		None	-	-	2
4000	CR		MH	M-L/Ref		Gly/HG	-	-	43
4001	CR		MH	NReg		None	-	-	9
4002	CR		MH	M-L/Ref	Portion s SURV	Gly/HG	-	-	16
4003	CR		MH	M-L/Ref		Gly/HG	-	-	12
4004	CR		MH	M-L/Ref	SURV	Gly/HG	-	-	10
4005	CR		M/P	M-U/Ref	Portion s SURV	Gly/HG	-	-	19
4006	WUI		HT/HP	NRec		None	-	-	27
4007	CR		SH	Upper to L/Ref		Gly/HG	-	-	49
4008	WUI		HT/HP	NRec		None	-	-	43
4009	WUI		HT/HP	NRec		None	-	-	25
4009	WUI		RDSAL	NRec		None	-	-	16
4010	CR		SH	Upper to L/Ref	SURV	Gly/HG	-	-	48
4011	CR		SH	M-L/Ref		Gly/HG	-	-	70
4012	CR		MH	Upper to L/Ref	SURV	Gly/HG	-	-	30
4013	CR		MH	M-L/Ref	SURV	Gly/HG	-	-	20
4014	WUI		HT/HP	NRec		None	-	-	19
4015	WUI		HT/HP	NRec		None	-	-	26
4016	WUI		HT/HP	NRec		None	-	-	3
4016	WUI		RDSAL	NRec		None	-	-	2
4017	SFMZ		MH	NReg		Gly/HG	-	-	44
4018	SPLAT		MH	NReg		None	-	-	40

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
4019	CR		SH	NReg		None	-	-	45
4020	SPLAT		MH	M-U/Ref		Gly/HG	-	-	124
4021	CR		SH	M-U/Ref	Portion s SURV	Gly/HG	-	-	61
4022	CR		MH	NReg		None	-	-	16
4023	SFMZ		MH	NReg		None	-	-	12
4024	SFMZ		MH	M-L/Ref		None	-	-	5
4025	Other		SH	NReg		None	-	-	369
5000	RD		RDSAL	NRec		None	-	-	3,604

APPENDIX D: UNIT TREATMENTS

TABLE LEGEND

Conifer Resilience	CR	Plant/Release	P/Rel
Strategic Fire Management Zone	SFMZ	Release of Planted Seedlings	Rel
Wildland Urban Intermix	WUI	Hand Thin and Hand Pile Small Material	HT/HP
Roadside	RD	Watershed Improvement Treatments	WS
Strategically Placed Landscape Treatment	SPLAT	Natural Recovery	NRec
Forest Resilience with Variable Snag Retention Study	VSS	Natural Regeneration	NReg
Variable SAL and Planting Study and WSA	Var/PL	SFMZ Reforestation	SFMZ/Ref
Watershed Sensitive Area	WSA	Mid to Upper Slope Reforestation Area	M-U/Ref
Resource Benefit	RB	Upper Slope Reforestation Area	U/Ref
Long Term Soil Productivity Study	LTSP	Mid to Lower Slope Reforestation Area	M-L/Ref
Control for Monitoring by the Regional Water Board	CVRWB	Lower Slope Reforestation Area	L/Ref
Prescribe Fire	PF	Mid Slope Reforestation Area	M/Ref
Roadside Salvage	RDSAL	Upper Slope Hardwood/Pine Reforestation Area	UHW/P/Ref
Mechanical Harvest	MH	Glyphosate or Hand Grub	Gly/HG
Hazard Tree Felling and Hand Piling of Small Material	HZ/HP	Survey 1st	SURV
Skyline Harvest	SH	Hardwood/Pine	HW/P
Masticate or Pile	M/P	Post Monitoring Gly/HG	Mon Gly/HG

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
0	Other		PF	NRec		PF	2,058	2,085	1,997
0	RD		RDSAL	NRec		PF	-	-	67
1	CR		MH	M-U/Ref		Gly/HG	214	214	214
2	CR		MH	U/Ref	SURV	Gly/HG	67	-	67
3	CR	CR with VSS	MH	M-U/Ref		Gly/HG	355	355	355
4	CR	WSA	MH	M-U/Ref		Gly/HG	5	5	5
5	SFMZ		MH	SFMZ/Ref		Gly/HG	21	21	21
21	Other	RB	HZ/HP	NRec		None	6	6	5
21	RD		RDSAL	NRec		None	-	-	1
22	Other	RB	HZ/HP	NRec		None	7	7	6
22	RD		RDSAL	NRec		None	-	-	1
23	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	29	-	29
24	CR		MH	M-L/Ref		Gly/HG	4	4	4
24	CR		SH	M-L/Ref		Gly/HG	13	12	13

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
25	SFMZ		MH	NReg		None	39	21	39
26	SFMZ		MH	NReg		None	6	4	6
27	WSA	WSA	MH	NRec		None	5	5	5
28	WSA	WSA	MH	NRec		None	5	5	5
30	WSA	WSA	MH	NRec		None	7	7	7
33	CR		MH	M-L/Ref	SURV	Gly/HG	30	-	30
34	CR		MH	M-L/Ref	SURV	Gly/HG	85	-	85
35	CR		MH	M-L/Ref	SURV	Gly/HG	42	-	42
37	CR		SH	Upper to L/Ref		Gly/HG	85	85	85
40	SFMZ		MH	SFMZ/Ref		Gly/HG	9	9	9
42	CR		MH	L/Ref		Gly/HG	3	3	3
43	CR		MH	M-L/Ref		Gly/HG	14	14	14
44	SFMZ		MH	NReg		None	69	43	69
45	CR		MH	M/Ref	SURV	Gly/HG	48	-	48
46	SFMZ		MH	NReg		None	41	31	41
47	SFMZ		MH	NReg		Gly/HG	82	51	82
48	SFMZ		MH	NReg		None	18	7	18
49	SFMZ		MH	NReg		None	78	20	78
50	SFMZ		MH	SFMZ/Ref		Gly/HG	157	112	157
51	CR		MH	M/Ref		Gly/HG	9	9	9
52	CR		MH	M-L/Ref		Gly/HG	35	35	35
53	SFMZ		MH	SFMZ/Ref		Gly/HG	5	5	5
54	SFMZ		MH	SFMZ/Ref		Gly/HG	5	2	5
55	SFMZ		MH	SFMZ/Ref		Gly/HG	3	2	3
56	SFMZ		MH	SFMZ/Ref		Gly/HG	14	14	14
57	SFMZ		MH	SFMZ/Ref		Gly/HG	1	1	1
58	SFMZ		MH	SFMZ/Ref		Gly/HG	14	13	14
61	SFMZ	RB	HZ/HP	NRec		None	6	-	6
62	Other	RB	HZ/HP	NRec		None	3	-	2
62	RD		RDSAL	NRec		None	-	-	1
63	SFMZ	RB	HZ/HP	NRec		None	6	-	4
65	Other	RB	HZ/HP	NRec		None	2	-	1
65	RD		RDSAL				-	-	1
66	SFMZ	RB	HZ/HP	NRec		None	6	6	2
66	RD		RDSAL	NRec		None	-	-	4
67	Other	RB	HZ/HP	NRec		None	3	-	3
70	SFMZ	RB	HZ/HP	NRec		None	2	2	2
71	Other	RB	HZ/HP	NRec		None	3	-	-
71	RD		RDSAL	NRec		None	-	-	3

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy	Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
72	Other	RB	HZ/HP	NRec	None	3	-	1
72	Other		RDSAL	NRec	None	-	-	2
73	Other	RB	HZ/HP	NRec	None	3	-	3
74	Other	RB	HZ/HP	NRec	None	2	-	1
74	RD		RDSAL	NRec	None	-	-	1
75	Other	RB	HZ/HP	NRec	None	2	-	1
75	RD		RDSAL	NRec	None	-	-	1
81	CR		SH	NReg	None	34	34	57
82	SFMZ		MH	NReg	None	12	12	12
83	SFMZ		MH	NReg	None	29	29	29
100	SFMZ		MH	SFMZ/Ref	Gly/HG	85	85	85
101	CR		MH	M/Ref	Gly/HG	180	180	180
104	SFMZ		MH	NReg	PF	18	18	18
200	CR		MH	M/Ref	Gly/HG	118	118	118
201	SFMZ		MH	SFMZ/Ref	Gly/HG	41	41	41
202	SFMZ		MH	SFMZ/Ref	Gly/HG	24	24	24
203	CR	CR with VSS	MH	M/Ref	Gly/HG	239	239	239
204	CR	CR with VSS	MH	M/Ref	Gly/HG	105	105	105
205	SFMZ		MH	SFMZ/Ref	Gly/HG	371	371	371
206	CR		MH	M-L/Ref	Gly/HG and BF	51	51	39
206	RD		RDSAL	M-L/Ref	Gly/HG and BF	-	-	12
207	CR		MH	U/Ref	Gly/HG and BF	6	6	3
207	RD		RDSAL	U/Ref	Gly/HG and BF	-	-	3
208	CR		SH	U/Ref	Gly/HG and BF	22	22	18
208	RD		RDSAL	U/Ref	Gly/HG and BF	-	-	4
301	CR		MH	M/Ref	Gly/HG	194	-	194
302	CR		MH	M/Ref	Gly/HG	27	27	27
303	CR		MH	NReg	Gly/HG	15	15	15
304	CR	WSA	MH	M-L/Ref	Gly/HG	42	42	42
306	CR	Var/PL	MH	M/Ref	Gly/HG	130	130	130
307	CR		MH	M/Ref	Gly/HG	20	20	20
308	CR	CR with VSS	MH	M/Ref	Gly/HG	101	101	101
309	CR		MH	M/Ref	Gly/HG	107	-	107
310	CR	Var/PL	MH	M/Ref	Gly/HG	111	111	111
311	CR		MH	M/Ref	Gly/HG	4	-	4

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
312	SFMZ		MH	SFMZ/Ref		Gly/HG	111	111	111
313	CR		M/P	M/Ref		Gly/HG	3	3	3
314	SFMZ		M/P	SFMZ/Ref		Gly/HG	7	7	7
315	SFMZ		M/P	SFMZ/Ref		Gly/HG	4	4	4
316	SFMZ		M/P	SFMZ/Ref		Gly/HG	3	3	3
317	SFMZ		MH	SFMZ/Ref		Gly/HG	18	18	18
318	SFMZ		MH	SFMZ/Ref		Gly/HG	12	12	12
319	SFMZ		M/P	SFMZ/Ref		Gly/HG	3	3	3
320	SFMZ		MH	SFMZ/Ref		Gly/HG	18	18	18
321	SFMZ		MH	SFMZ/Ref		Gly/HG	6	6	6
323	SFMZ		MH	SFMZ/Ref		Gly/HG	59	59	59
324	CR		M/P	M/Ref		Gly/HG	2	324	2
325	SFMZ		MH	SFMZ/Ref		Gly/HG	11	11	11
326	SFMZ		MH	SFMZ/Ref		Gly/HG and BF	36	36	21
327	SFMZ		MH	SFMZ/Ref		Gly/HG and BF	18	18	18
330	HW/P		MH	UHW/P/Ref		Gly/HG	43	43	43
331	HW/P		MH	UHW/P/Ref		Gly/HG	20	20	20
332	SFMZ		MH	SFMZ/Ref		Gly/HG	69	69	69
333	SFMZ		MH	SFMZ/Ref		Gly/HG	107	107	107
403	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	21	21	21
404	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	4	4	4
450	CR		MH	U/Ref		Gly/HG	19	19	19
451	CR		MH	U/Ref		Gly/HG	19	19	19
452	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	16	15	16
453	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	15	14	15
501	SFMZ		P/Rel	SFMZ/Ref		Gly/HG	7	7	7
502	CR		P/Rel	M/Ref		Gly/HG	5	5	5
503	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	63	63	63
504	SFMZ	WSA	P/Rel	SFMZ/Ref		Gly/HG	39	39	39
509	CR		Rel	M/Ref		Gly/HG	14	14	14
510	CR	CR with VSS	MH	M/Ref		Gly/HG	97	97	97
511	CR		SH	M-L/Ref		Gly/HG	67	-	67
512	CR		MH	M/Ref		Gly/HG	14	14	14
514	CR		MH	M/Ref		Gly/HG	8	8	8
515	CR	Var/PL WSA	MH	M/Ref		Gly/HG	271	271	271
516	CR	LTSP	Rel	8x8		Gly/HG	10	10	10
518	SFMZ		MH	SFMZ/Ref		Gly/HG	161	161	161
522	CR		MH	L/Ref		Gly/HG	4	4	4

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
523	CR		MH	M-L/Ref		Gly/HG	13	13	13
524	CR		MH	M/Ref		Gly/HG	3	3	3
525	CR		MH	M/Ref		Gly/HG	24	24	24
526	CR		MH	M-L/Ref		Gly/HG	11	11	11
527	CR		MH	M/Ref		Gly/HG	7	7	7
528	CR	LTSP	Rel	8x8		Gly/HG	8	8	8
529	CR	LTSP	Rel	8x8		Gly/HG	9	9	9
530	CR		MH	M/Ref		Gly/HG	9	9	9
531	CR		MH	M/Ref		Gly/HG	11	11	11
532	CR	Var/PL	MH	M-L/Ref	SURV	Gly/HG	57	57	57
533	CR		MH	M/Ref		Gly/HG	3	-	3
535	CR		MH	M/Ref		Gly/HG	12	12	12
537	CR		MH	M/Ref		Gly/HG	29	29	29
539	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	44	31	44
540	CR	CR with VSS	MH	M-U/Ref	SURV	Gly/HG	96	96	96
541	CR	WSA	MH	M-U/Ref		Gly/HG	20	20	20
542	SFMZ		MH	SFMZ/Ref		Gly/HG	2	2	2
543	CR		MH	U/Ref		Gly/HG	2	2	2
547	SFMZ	Var/PL	MH	SFMZ/Ref		Gly/HG	49	49	49
554	CR		MH	M/Ref		Gly/HG	6	6	6
555	CR		MH	M/Ref		Gly/HG	4	4	4
556	CR	WSA	MH	M-L/Ref		Gly/HG	24	23	24
557	CR		MH	M/Ref		Gly/HG	24	24	24
559	CR	WSA	MH	M/Ref		Gly/HG	9	9	9
561	CR	CR with VSS	MH	M-U/Ref	SURV	Gly/HG	40	40	40
562	CR	CR with VSS	MH	M/Ref		Gly/HG	44	44	44
563	CR	CR with VSS	MH	M-L/Ref	SURV	Gly/HG	62	62	62
654	CR		MH	M-L/Ref	SURV	Gly/HG	7	7	7
565	CR		MH	M/Ref		Gly/HG	28	28	28
566	CR	WSA	MH	Upper to L/Ref		Gly/HG	73	73	73
567	CR	WSA	MH	M/Ref		Gly/HG	18	18	18
568	CR	Var/PL WSA	MH	M-U/Ref		Gly/HG	77	77	77
601	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	18	18	18
603	SFMZ	WSA	WS	SFMZ/Ref	SURV	Gly/HG	16	16	16
606	Other	RB	HZ/HP	NRec		None	103	103	103
607	CR		M/P	M/Ref		Gly/HG	22	22	22
608	CR		M/P	M-U/Ref		Gly/HG	16	16	16

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy	Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
609	CR		M/P	M-U/Ref	Gly/HG	6	6	6
610	CR		M/P	M/Ref	Gly/HG	10	10	10
611	CR		MH	M-U/Ref	Gly/HG	17	17	17
612	CR		M/P	M/Ref	Gly/HG	25	25	25
613	CR		MH	M/Ref	Gly/HG	4	4	4
614	CR		M/P	M/Ref	Gly/HG	7	7	7
615	SFMZ		MH	SFMZ/Ref	Gly/HG	22	22	22
616	CR		P/Rel	M/Ref	Gly/HG	5	5	5
617	SFMZ		M/P	SFMZ/Ref	Gly/HG	18	18	18
618	SFMZ		MH	SFMZ/Ref	Gly/HG	17	17	17
619	SFMZ		MH	SFMZ/Ref	Gly/HG	14	14	14
620	SFMZ		P/Rel	SFMZ/Ref	Gly/HG	2	2	2
621	SFMZ		P/Rel	SFMZ/Ref	Gly/HG	10	10	10
622	SFMZ		MH	SFMZ/Ref	Gly/HG	3	3	3
623	CR		P/Rel	M/Ref	Gly/HG	9	9	9
624	SFMZ		P/Rel	SFMZ/Ref	Gly/HG	3	3	3
625	CR		MH	M/Ref	Gly/HG	6	-	6
626	CR	WSA	MH	M-U/Ref	Gly/HG and BF	89	89	77
626	RD		RDSAL	M-U/Ref	Gly/HG and BF	-	-	12
627	CR		M/P	M-U/Ref	Gly/HG and BF	5	5	5
629	CR	WSA	P/Rel	M-U/Ref	Gly/HG	5	5	5
630	CR		M/P	M-U/Ref	Gly/HG	10	10	10
631	CR	WSA	MH	M-U/Ref	Gly/HG	33	17	33
632	CR		MH	M-U/Ref	Gly/HG	36	-	36
633	CR		Rel	M-U/Ref	Gly/HG and BF	188	188	170
633	CR		RDSAL	M-U/Ref	Gly/HG	-	-	11
634	SFMZ		MH	SFMZ/Ref	Gly/HG	16	16	16
635	CR		P/Rel	M/Ref	Gly/HG	7	7	7
636	CR		P/Rel	M/Ref	Gly/HG	11	11	11
637	CR		P/Rel	M/Ref	Gly/HG	13	13	13
640	SFMZ		M/P	SFMZ/Ref	Gly/HG	2	2	2
641	CR		M/P	M/Ref	Gly/HG and BF	6	6	6
642	CR		P/Rel	M/Ref	Gly/HG	14	14	14
643	CR		P/Rel	M/Ref	Gly/HG	18	18	18
644	CR		P/Rel	M/Ref	Gly/HG	25	25	25
645	SFMZ		M/P	SFMZ/Ref	Gly/HG	4	4	4
646	CR		M/P	M/Ref	Gly/HG	10	10	10

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
647	CR		M/P	M/Ref		Gly/HG	10	10	10
648	CR		M/P	M/Ref		Gly/HG	4	4	4
649	SFMZ		P/Rel	SFMZ/Ref		Gly/HG	19	19	19
651	CR		M/P	M-L/Ref		Gly/HG	8	8	8
652	CR		M/P	M-L/Ref		Gly/HG and BF	11	11	11
653	CR		M/P	M-L/Ref		Gly/HG and BF	4	4	4
654	CR		M/P	M-U/Ref		Gly/HG and BF	16	15	16
657	CR		M/P	M-U/Ref		Gly/HG and BF	5	5	5
660	SFMZ		HT/HP	NRec		PF	114	116	114
661	Other		HZ/HP	NRec		PF	1	1	1
662	SFMZ		SH	SFMZ/Ref		Gly/HG and BF	8	8	8
663	CR		MH	M/Ref		Gly/HG and BF	38	38	38
665	SFMZ		HT/HP	SFMZ/Ref		Gly/HG and BF	44	44	37
665	SFMZ		RDSAL	SFMZ/Ref		Gly/HG and BF	-	-	7
666	SFMZ		MH	SFMZ/Ref		Gly/HG and BF	71	71	71
667	Other		MH	NReg		PF	28	-	26
667	RD		RDSAL	NReg		PF	-	-	2
668	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	191	191	191
669	SFMZ		MH	SFMZ/Ref		Gly/HG	101	101	101
673	SFMZ		P/Rel	SFMZ/Ref		Gly/HG	19	19	19
674	SFMZ		HT/HP	NRec		PF	15	15	15
675	SFMZ		MH	NReg		PF	304	303	256
676	CR	WSA	MH	M/Ref		Hand Grub	16	16	16
677		WSA	WS	NRec		None	35	35	35
679	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	161	147	161
680	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	43	34	43
681	CR		MH	Upper to L/Ref		Gly/HG	415	249	415
682	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	7	4	7
683	SFMZ		MH	SFMZ/Ref		Gly/HG	27	1	27
684	SFMZ		MH	SFMZ/Ref		Gly/HG	8	8	8
685	SFMZ		MH	SFMZ/Ref		Gly/HG	84	56	84
687	SFMZ		MH	SFMZ/Ref		Gly/HG	32	32	32
688	SFMZ		MH	SFMZ/Ref		Gly/HG	9	1	9
689	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	32	32	32
690	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	8	2	8

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
692	SFMZ		MH	NReg		None	8	3	8
693	SFMZ		MH	SFMZ/Ref		Gly/HG	2	2	2
694	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	8	8	8
695	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	21	20	21
696	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	7	-	7
697	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	2	2	2
699	CR		MH	M/Ref		Gly/HG	10	10	10
700	CR		M/P	M/Ref		Gly/HG	23	-	23
701	CR		M/P	M/Ref		Gly/HG	10	10	10
702	CR		M/P	M-U/Ref		Gly/HG	9	8	8
703	CR		M/P	M-L/Ref		Gly/HG	28	4	28
704	CR		M/P	M-U/Ref		Gly/HG	14	3	14
705	CR		MH	M-L/Ref		Gly/HG	5	4	5
706	CR		MH	M-U/Ref		Gly/HG	15	-	15
707	CR		M/P	M/Ref		Gly/HG	7	-	7
708	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	14	14	14
709	CR		M/P	M/Ref		Gly/HG	5	5	5
710	CR		M/P	M-U/Ref		Gly/HG	6	6	6
711	CR		M/P	M-U/Ref		Gly/HG	11	11	11
712	SFMZ		M/P	SFMZ/Ref		Gly/HG	1	1	1
713	SFMZ		M/P	SFMZ/Ref		Gly/HG	4	4	4
714	CR		M/P	M/Ref		Gly/HG	15	15	15
716	CR		M/P	M/Ref		Gly/HG	13	13	13
717	CR		M/P	M/Ref		Gly/HG	10	10	10
719	CR		MH	U/Ref		Gly/HG	6	5	6
722	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	15	13	13
723	SFMZ		M/P	SFMZ/Ref		Gly/HG	25	25	25
724	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	8	8	8
725	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	26	26	26
727	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	22	10	22
728	Other		HZ/HP	NRec		None	3	3	-
729	HW/P	RB	HZ/HP	UHW/P/Ref		Gly/HG	7	7	6
729	RD		RDSAL	UHW/P/Ref		Gly/HG	-	-	1
733	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	30	22	30
734	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	67	67	67
735	SFMZ		MH	SFMZ/Ref		Gly/HG	46	19	46
736	CR		MH	M/Ref		Gly/HG	34	-	36
737	SFMZ		MH	NRec		None	220	164	220
738	SFMZ		MH	SFMZ/Ref	Portion s SURV	Gly/HG	122	54	122

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
739	SFMZ		MH	SFMZ/Ref		Gly/HG	7	6	7
740	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	53	34	53
741	SFMZ		MH	NRec		None	1	1	1
742	SFMZ		MH	NRec		None	3	-	3
743	SFMZ		MH	NRec		None	1	1	1
744	SFMZ		MH	SFMZ/Ref		Gly/HG	3	3	3
745	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	31	18	31
746	SFMZ		MH	SFMZ/Ref		Gly/HG	10	8	10
747	SFMZ		MH	NRec		None	20	18	20
748	SFMZ		MH	NRec		None	<1	-	-
749	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	9	6	9
750	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	9	-	9
751	SFMZ		MH	NRec		None	11	9	11
752	SFMZ	CVRWB	MH	SFMZ/Ref		Mon Gly/HG	49	33	49
753	SFMZ	CVRWB	SH	SFMZ/Ref	SURV	Mon Gly/HG	11	-	11
754	SFMZ	CVRWB	MH	SFMZ/Ref	SURV	Mon Gly/HG	83	35	83
756	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	38	11	38
757	SFMZ		MH	NReg		None	9	8	9
758	SFMZ		MH	NReg		None	2	2	1
759	SFMZ		MH	NReg		None	1	1	1
760	SFMZ		MH	NReg		None	3	3	3
761	SFMZ		MH	NReg		None	4	4	4
762	SFMZ		MH	NReg		None	7	7	7
763	SFMZ		MH	NReg		None	2	2	2
764	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	30	10	30
765	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	60	33	60
766	SFMZ		MH	NReg		None	17	15	17
767	SFMZ		MH	NReg		None	21	13	21
768	SFMZ		MH	NReg		None	14	9	14
769	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	4	4	4
770	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	9	5	9
772	SFMZ		MH	NReg		None	20	19	20
773	SFMZ		MH	NReg		None	13	9	13
774	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	42	18	42
775	SFMZ		MH	NReg		None	6	5	6
776	SFMZ		MH	NReg		None	1	1	1
777	SFMZ		MH	NReg		None	29	27	29
778	SFMZ		MH	NReg		None	82	54	82

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
779	SFMZ		MH	NReg		None	39	34	38
781	SFMZ		HT/HP	NRec		None	50	-	46
781	RD		RDSAL	NRec		None	-	-	4
782	SFMZ		HT/HP	NRec		None	105	-	90
782	SFMZ		RDSAL	NRec		None	-	-	15
783	SFMZ		HT/HP	NRec		None	106	-	69
783	SFMZ		RDSAL	NRec		None	-	-	38
784	SFMZ		HT/HP	NRec		None	88	15	78
784	SFMZ		RDSAL	NRec		None	-	-	11
785	SFMZ		HT/HP	NRec		None	60	58	7
785	SFMZ		RDSAL	NRec		None	-	-	53
786	SFMZ		HT/HP	NRec		PF	22	22	19
786	SFMZ		RDSAL	NRec		PF	-	-	3
787	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	24	22	24
788	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	21	17	21
789	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	11	11	11
790	SFMZ		MH	NRec		None	5	3	5
791	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	54	49	54
793	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	72	15	72
794	SFMZ		MH	NReg		None	81	45	81
795	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	372	180	372
796	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	22	6	22
797	WUI		MH	SFMZ/Ref	SURV	Gly/HG	37	37	37
798	WUI		MH	SFMZ/Ref	SURV	Gly/HG	22	22	22
799	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	7	-	7
800	SFMZ		MH	NReg		None	8	8	8
801	SFMZ		MH	NReg		None	4	4	4
802	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	5	4	5
803	SFMZ		MH	NReg		None	28	26	28
804	SFMZ		MH	SFMZ/Ref		Gly/HG	6	-	-
805	SFMZ		MH	SFMZ/Ref		Gly/HG	7	7	7
806	WUI		M/P and HZ	SFMZ/Ref		Gly/HG	49	49	49
807	WUI		HT/HP	NRec		None	58	58	58
808	WUI		HT/HP	NRec		None	10	10	10
809	WUI		MH	SFMZ/Ref	SURV	Gly/HG	34	34	34
810	WUI		MH	NReg		None	16	16	16
811	SFMZ		HT/HP	NRec		None	26	-	26
812	WUI		M/P and HZ	SFMZ/Ref		Gly/HG	15	15	15
813	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	13	11	13

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
814	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	9	9	9
815	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	5	3	5
816	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	13	11	13
817	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	7	7	7
818	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	13	12	13
820	SFMZ		MH	NReg		None	3	3	3
821	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	13	-	13
822	SFMZ		MH	SFMZ/Ref		Gly/HG	2	-	2
823	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	4	1	4
824	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	28	4	28
825	SFMZ		MH	NReg		None	7	7	7
826	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	107	58	107
827	WUI		M/P and HZ	NRec		None	208	208	208
828	SFMZ		M/P	NRec		None	4	3	4
829	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	2	2	2
830	SFMZ		M/P	NRec		None	19	1	19
831	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	3	3	3
832	SFMZ	CVRWB	M/P	NRec		None	8	7	8
833	SFMZ		M/P	NRec		None	4	3	4
834	SFMZ		M/P	NRec		None	14	2	14
835	SFMZ		M/P	NRec		None	13	11	13
836	SFMZ		M/P	SFMZ/Ref		Gly/HG	4	4	4
837	SFMZ		M/P	NRec		None	5	4	5
838	SFMZ		M/P	NRec		None	11	11	11
839	WUI		M/P	NRec		None	7	7	7
842	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	5	4	5
844	CR		M/P	M-L/Ref	SURV	Gly/HG	8	-	8
845	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	11	7	11
846	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	23	3	23
847	CR		M/P	M-L/Ref	SURV	Gly/HG	6	-	6
848	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	9	6	9
849	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	16	-	16
850	SFMZ		M/P	NRec		None	12	8	12
851	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	27	13	27
852	WUI		MH	NReg		None	46	46	46
853	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	25	19	25
856	CR		M/P	U/Ref	SURV	Gly/HG	16	-	16
857	SFMZ	CVRWB	M/P	SFMZ/Ref	SURV	Mon Gly/HG	17	11	17

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
858	SFMZ	CVRWB	M/P	SFMZ/Ref	SURV	Mon Gly/HG	13	9	13
859	SFMZ		M/P	NRec		None	23	20	23
860	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	12	10	12
861	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	15	3	15
862	CR		M/P	M-L/Ref	SURV	Gly/HG	8	-	9
867	CR		M/P	U/Ref	SURV	Gly/HG	4	-	4
868	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	32	24	32
870	SFMZ	WSA	M/P	SFMZ/Ref		Gly/HG	21	12	21
871	WUI		M/P	SFMZ/Ref	SURV	Gly/HG	4	4	4
872	WUI		M/P	SFMZ/Ref	SURV	Gly/HG	4	4	4
873	WUI		M/P	SFMZ/Ref	SURV	Gly/HG	17	16	16
874	SFMZ		P/Rel	SFMZ/Ref	SURV	Gly/HG	8	5	8
876	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	13	-	13
877	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	31	-	31
878	CR	WSA	M/P	M-L/Ref	SURV	Gly/HG	23	4	23
879	SFMZ		M/P	SFMZ/Ref		Gly/HG	9	2	9
880	SFMZ		M/P	SFMZ/Ref		Gly/HG	11	3	11
881	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	6	-	6
882	CR		M/P	U/Ref	SURV	Gly/HG	6	-	6
883	SFMZ	WSA	M/P	SFMZ/Ref		Gly/HG	16	16	16
884	WUI		MH	SFMZ/Ref	SURV	Gly/HG	14	14	14
885	CR		P/Rel	M-U/Ref		Gly/HG	2	-	2
886	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	173	98	173
887	CR		M/P	M-L/Ref	SURV	Gly/HG	5	-	5
888	CR		M/P	M-L/Ref	SURV	Gly/HG	8	-	8
889	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	9	8	9
890	CR		M/P	M-L/Ref	SURV	Gly/HG	13	-	13
891	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	3	3	3
892	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	11	-	11
893	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	3	3	3
894	SFMZ		M/P	SFMZ/Ref		Gly/HG	16	14	16
895	SFMZ		M/P	SFMZ/Ref		Gly/HG	19	-	19
896	SFMZ		M/P	SFMZ/Ref		Gly/HG	24	2	24
897	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	11	4	11
898	SFMZ		M/P	SFMZ/Ref		Gly/HG	2	-	2
899	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	18	17	18
900	SFMZ		M/P	SFMZ/Ref		Gly/HG	4	1	4
901	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	6	6	6
902	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	8	3	8

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
903	SFMZ		P/Rel	SFMZ/Ref	SURV	Gly/HG	2	1	2
904	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	5	-	5
905	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	15	11	15
906	SFMZ		HZ/HP	SFMZ/Ref	SURV	Gly/HG	33	19	18
906	RD		RDSAL	SFMZ/Ref	SURV	Gly/HG	-	-	15
907	SFMZ		P/Rel	SFMZ/Ref	SURV	Gly/HG	1	1	1
908	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	7	7	7
910	SFMZ		MH	NReg		None	81	55	81
912	SFMZ		HZ/HP	NRec		None	66	59	25
912	SFMZ		RDSAL	NRec		None	-	-	41
914	CR	WSA	WS	L/Ref		Gly/HG	46	46	46
915	SFMZ	WSA	WS	SFMZ/Ref		Gly/HG	21	21	21
916	SFMZ	WSA	WS	SFMZ/Ref		Gly/HG	10	10	7
917	Other	WSA	WS	NRec		None	8	8	8
918	CR	WSA	WS	U/Ref		Gly/HG	16	16	16
919	Other	WSA	WS	NRec		None	20	20	20
924	WUI		HZ/HP	NRec		None	77	77	56
924	RD		RDSAL	NRec		None	-	-	21
925	WUI		M/P and HZ	NRec		None	192	192	192
926	WUI		HT/HP	NRec		None	5	5	5
927	SFMZ	WSA	MH	SFMZ/Ref		Gly/HG	74	39	74
928	SFMZ		MH	SFMZ/Ref		Gly/HG	90	53	90
929	SFMZ		MH	SFMZ/Ref		Gly/HG	2	2	2
932	SFMZ	WSA	WS	NRec		None	3	3	3
933	CR	WSA	WS			Gly/HG	43	43	43
935	WUI	WSA	HT/HP	NRec		None	152	152	124
935	WUI		RDSAL	NRec		None	-	-	27
936	SFMZ	WSA	MH	SFMZ/Ref	SURV	Gly/HG	248	163	248
937	SFMZ		MH	NReg		None	1	-	2
938	SFMZ		MH	NReg		None	3	-	3
939	SFMZ		MH	SFMZ/Ref		Gly/HG	16	-	16
941	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	76	47	76
942	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	46	29	46
943	SFMZ		MH	NReg		None	34	17	34
944	SFMZ		MH	NReg		None	44	28	44
945	SFMZ		MH	NReg		None	18	12	18
946	SFMZ		MH	NReg		None	59	32	59
947	SFMZ		MH	NReg		None	53	47	53
948	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	20	-	20

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
949	SFMZ		MH	NReg		None	25	5	25
950	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	100	49	100
951	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	2	2	2
953	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	130	62	130
954	SFMZ		MH	SFMZ/Ref	SURV	Gly/HG	59	15	59
955	Other	WSA	WS	NRec		None	20	20	20
956	Other		HZ/HP	NRec		None	5	5	4
956	RD		RDSAL	NRec		None	-	-	1
957	SFMZ		M/P	SFMZ/Ref	SURV	Gly/HG	19	19	19
959	SFMZ		M/P and HZ	NRec		None	16		16
2026	CR		MH	U/Ref	SURV	Gly/HG	-	-	149
2027	CR		MH	U/Ref	SURV	Gly/HG	-	-	14
2028	CR		MH	M-U/Ref	SURV	Gly/HG	-	-	38
2029	CR		MH	U/Ref	SURV	Gly/HG	-	-	15
2030	SFMZ		MH	NReg		None	-	-	3
2031	SFMZ		MH	NReg		None	-	-	2
4000	CR		MH	M-L/Ref		Gly/HG	-	-	43
4001	CR		MH	NReg		None	-	-	9
4002	CR		MH	M-L/Ref	Portion s SURV	Gly/HG	-	-	16
4003	CR		MH	M-L/Ref		Gly/HG	-	-	12
4004	CR		MH	M-L/Ref	SURV	Gly/HG	-	-	10
4005	CR		M/P	M-U/Ref	Portion s SURV	Gly/HG	-	-	19
4006	WUI		HT/HP	NRec		None	-	-	27
4007	CR		SH	Upper to L/Ref		Gly/HG	-	-	49
4008	WUI		HT/HP	NRec		None	-	-	43
4009	WUI		HT/HP	NRec		None	-	-	25
4009	WUI		RDSAL	NRec		None	-	-	16
4010	CR		SH	Upper to L/Ref	SURV	Gly/HG	-	-	48
4011	CR		SH	M-L/Ref		Gly/HG	-	-	70
4012	CR		MH	Upper to L/Ref	SURV	Gly/HG	-	-	30
4013	CR		MH	M-L/Ref	SURV	Gly/HG	-	-	20
4014	WUI		HT/HP	NRec		None	-	-	19
4015	WUI		HT/HP	NRec		None	-	-	26
4016	WUI		HT/HP	NRec		None	-	-	3
4016	WUI		RDSAL	NRec		None	-	-	2
4017	SFMZ		MH	NReg		Gly/HG	-	-	44
4018	SPLAT		MH	NReg		None	-	-	40

Unit Number	Mgmt Zone	Special Treatment Designs	Initial Treatment	Reforestation Strategy		Release Methods	ALT. 2 and 5 (acres)	ALT. 3 (acres)	ALT. 4 (acres)
4019	CR		SH	NReg		None	-	-	45
4020	SPLAT		MH	M-U/Ref		Gly/HG	-	-	124
4021	CR		SH	M-U/Ref	Portions SURV	Gly/HG	-	-	61
4022	CR		MH	NReg		None	-	-	16
4023	SFMZ		MH	NReg		None	-	-	12
4024	SFMZ		MH	M-L/Ref		None	-	-	5
4025	Other		SH	NReg		None	-	-	369
5000	RD		RDSAL	NRec		None	-	-	3,604

APPENDIX E

Evaluation of California Spotted Owl PACs in the King Fire

Protected Activity Centers or PACs are land management allocations that are identified and managed to provide nesting and roosting habitat for Spotted Owls. This species is designated as Sensitive by the Regional Forester to receive special management consideration. Specific standards and guidelines have been developed for conservation of this species and are part of the Forest Plan direction for the Eldorado National Forest. Forty-six PACs occurred wholly or partially with the King Fire (Table 1).

Table 1. PACs located entirely or partially within the boundary of the King Fire.

Species	# of PACs on the Eldorado NF	# of PACs in the King Fire
California spotted owl	214	46

Forest Plan direction requires that following a disturbance event such as the King Fire, habitat conditions be evaluated to determine whether there is sufficient suitable habitat remaining in the PAC after the event or if there are opportunities for re-mapping the PAC to better encompass suitable habitat within a 1.5-mile distance from the owl activity center. The following habitat evaluation was conducted in order to remap PACs. The PAC mapping process is ongoing and adaptive since results from 2015 and subsequent spotted owl surveys will be used to further adjust PAC boundaries and to delineate additional or new PACs where new territorial spotted owls are detected. The following information has been used to evaluate habitat conditions: post-fire imagery (Worldview imagery from January 2015), burn severity mapping (basal area loss determined from RAVG BA4, 10/07/2014, and Forest Service e-vegetation database, NRM 2005).

Spotted Owl PACs

Wildlife biologists from the Eldorado National Forest evaluated habitat conditions within and around each of the 46 spotted owl PACs in the fire area. The location and amount of post-fire nesting/roosting habitat was evaluated for each owl territory at the following scales: 1) within the boundary of the PAC; 2) within a circular 1,000-ac territory (represented by a 1,128-m circle surrounding the territory center); and 3) within 1.5 miles of the owl activity center (defined as the most recent nest or roost location) (Table 2). Pre-fire habitat was mapped as the following California Wildlife Habitat Relationships (CWHR) size and canopy cover classes in conifer and montane hardwood-conifer types: size classes 4, 5 and 6, canopy cover classes M and D. Post-fire nesting/roosting habitat was assumed to occur in pre-fire habitat with less than 50 percent basal area mortality, using RAVG mapping.

Habitat in PACs prior to and following remapping is displayed in Table 3; 10 PACs that have not been remapped are shown in Table 4 and Figure 1. PACs were not retained or remapped for 10 spotted owl activity centers within the King Fire. These activity centers had less than 10 acres of habitat with less than 50% basal area mortality remaining in the PAC and within 0.7 miles of the territory center. The

PACs listed in Tables 3 and 4 are individually displayed with Worldview post-fire imagery (January 2015). Live vegetation appears red in the imagery.

Table 2. Pre-fire habitat and post-fire nesting/roosting habitat on NFS lands in PACs, circular territories, and within a 1.5 mile radius of owl activity centers (ACs).

CSO PAC ID	Pre-fire Habitat In PAC	Post-fire Nesting/Roosting Habitat in PAC	Post-Fire Nesting/Roosting Habitat in 1,000-ac Territory	Post-Fire Nesting/Roosting Habitat within 1.5-mi from AC[1]
ELD0001	291	291	482	1192
ELD0009	362	358	401	888
ELD0012	279	232	563	1727
ELD0015	300	219	553	2032
ELD0036	270	148	290	526
ELD0040	273	53	77	490
ELD0042	278	221	546	1252
ELD0051	288	201	257	617
ELD0052	294	149	207	850
ELD0057	305	65	191	731
ELD0058	300	75	172	651
ELD0060	300	107	255	1156
ELD0067	308	150	74	1618
ELD0068	289	3	15	144
ELD0081	304	304	645	2610
ELD0085	300	17	71	199
ELD0086	319	305	588	1814
ELD0140	297	16	217	618
ELD0206	24	8	207	689
ELD0213	367	367	580	904
ELD0216	296	175	399	1359
ELD0217	259	243	447	1341
ELD0219	307	282	142	508
ELD0300	263	113	95	458
ELD0303	289	231	420	1164
PLA0007	283	139	241	698
PLA0011	295	295	471	1777
PLA0012	300	0	0	0
PLA0013	269	269	373	1000
PLA0015	295	0	0	281
PLA0016	304	304	481	591
PLA0038	306	306	493	1327
PLA0039	303	130	269	1026
PLA0040	300	290	509	1326
PLA0043	263	0	2	82
PLA0049	255	0	5	102
PLA0050	274	0	0	25
PLA0051	274	201	297	775
PLA0065	233	0	4	368
PLA0067	299	0	2	62

CSO PAC ID	Pre-fire Habitat In PAC	Post-fire Nesting/Roosting Habitat in PAC	Post-Fire Nesting/Roosting Habitat in 1,000-ac Territory	Post-Fire Nesting/Roosting Habitat within 1.5-mi from AC[1]
PLA0080	257	174	408	1050
PLA0098	285	285	494	607
PLA0101	165	155	194	540
PLA0109	271	0	0	26
PLA0113	296	7	7	131
PLA0122	306	206	421	977

1Figures do not include acreages overlapping with other spotted owl PACs.

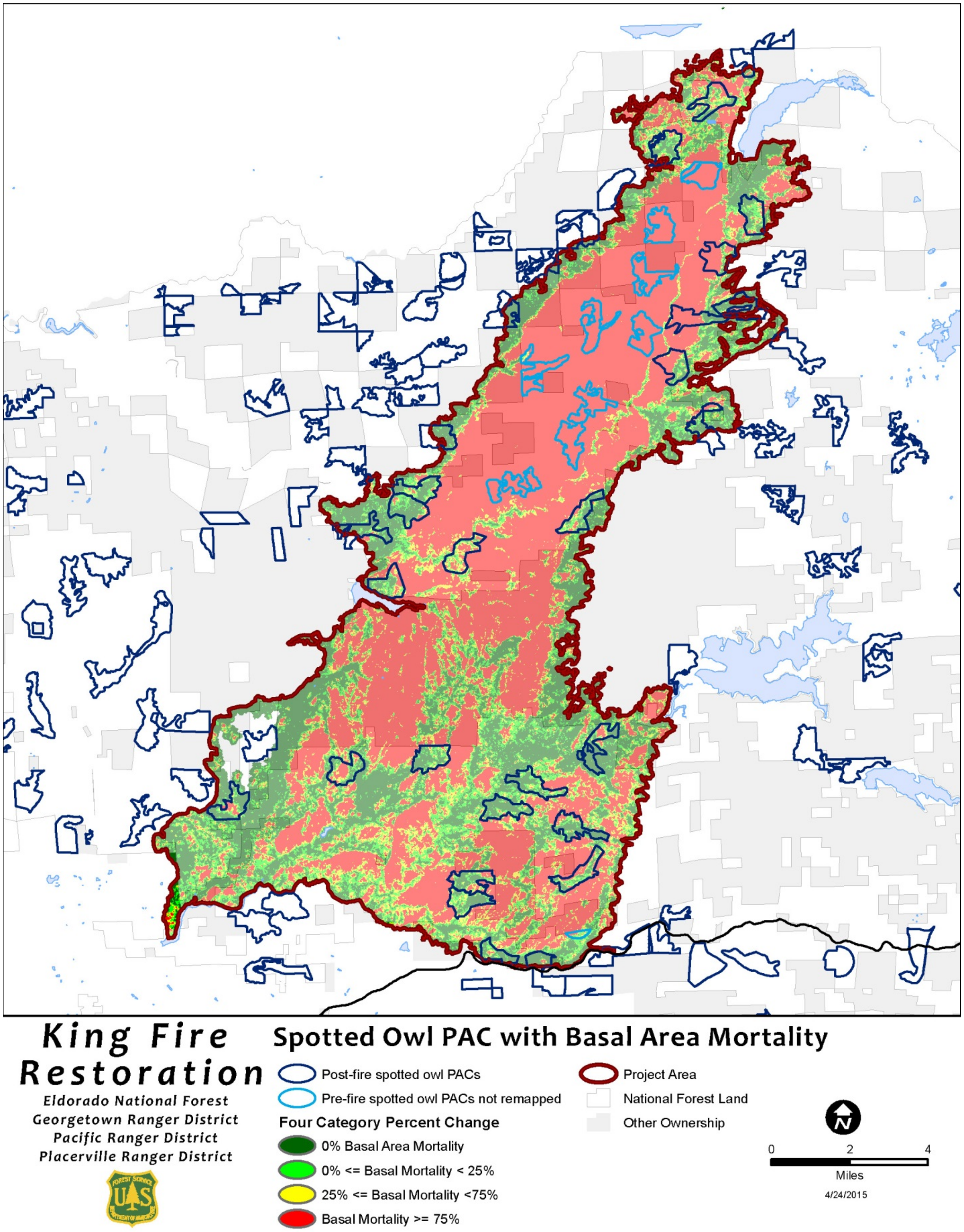
Table 3. PACs Remapped.

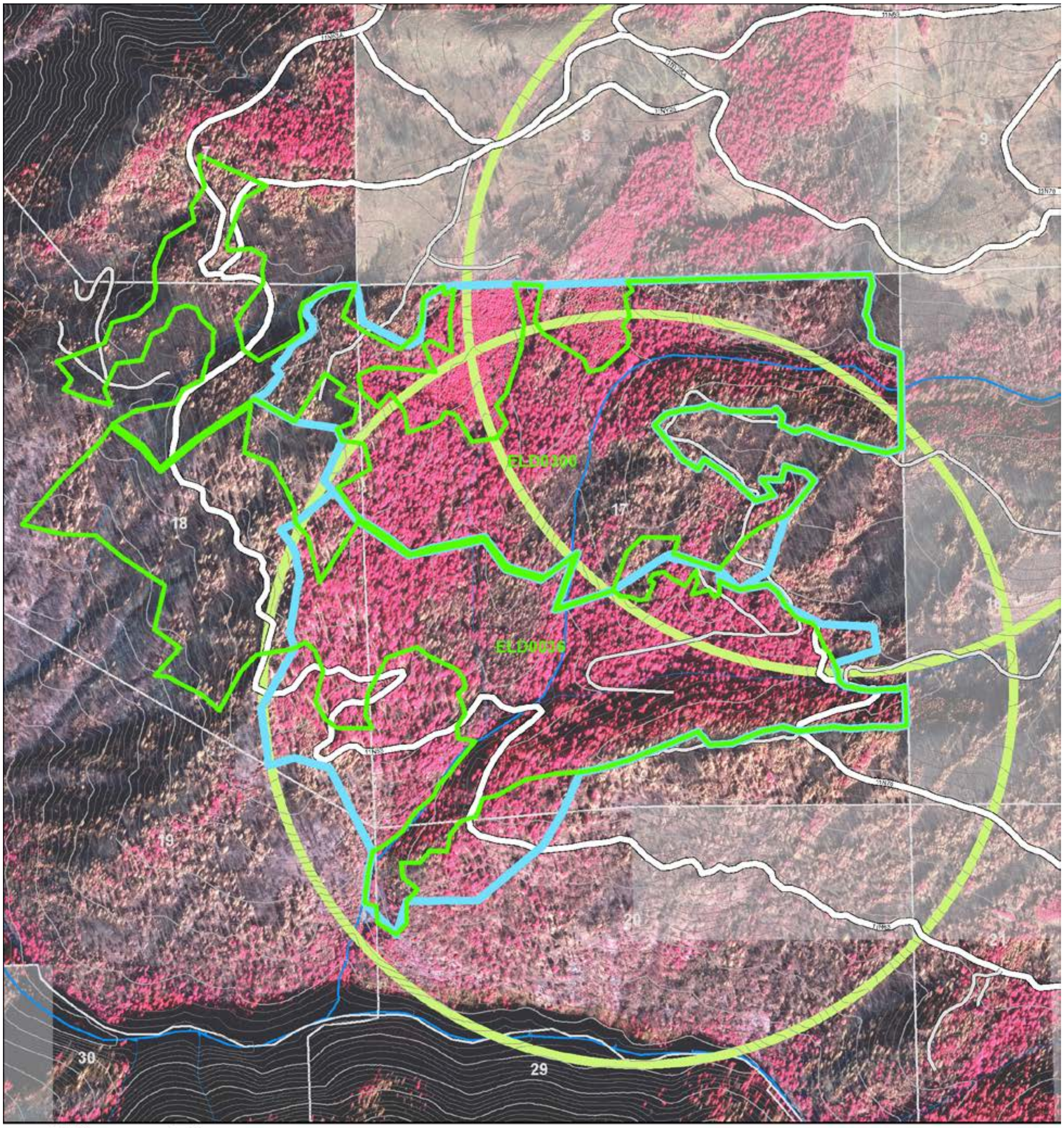
CSO PAC ID	Post-fire Nesting/Roosting Habitat in PAC	Post-fire Nesting/Roosting Habitat in Remapped PAC
PLA0007	139	139
PLA0051	201	201
ELD0036	148	173
ELD0040	53	77
ELD0052	149	188
ELD0068	3	46
ELD0085	17	150
ELD0140	16	142
ELD0216	175	215
ELD0300	113	124
ELD0303	231	237
PLA0039	130	208
PLA0080	174	192

Table 4. Habitat information for PACs not remapped.

CSO PAC ID	Post-fire Nesting/Roosting Habitat in PAC	Post-Fire Nesting/Roosting Habitat in 1,000-ac Territory	Post-Fire Nesting/Roosting Habitat within 1.5-mi from AC[1]	Reason for not Remapping
ELD0206	**8**	**207**	**689**	Activity Center occurred on private land.
PLA0012	**0**	**0**	**0**	Insufficient nesting/roosting habitat within 1.5 miles of activity center
PLA0015	**0**	**0**	**281**	281 acres of nesting/roosting habitat is alongside PAC PLA0053 and surrounded by industrial timberlands – surrounding foraging habitat is highly limited.
PLA0043	**0**	**2**	**82**	Insufficient nesting/roosting habitat within 1.5 miles of activity center (see map)

CSO PAC ID	Post-fire Nesting/Roosting Habitat in PAC	Post-Fire Nesting/Roosting Habitat in 1,000-ac Territory	Post-Fire Nesting/Roosting Habitat within 1.5-mi from AC[1]	Reason for not Remapping
PLA0049	**0**	**5**	**102**	Remaining habitat occurs in a small stringer along the Rubicon River and along the fire perimeter 1.5 miles from A.C. (see map). Unclear where to map a PAC.
PLA0050	**0**	**0**	**25**	Insufficient nesting/roosting habitat within 1.5 miles of activity center.
PLA0065	**0**	**4**	**368**	Possible remap west of Hell Hole Reservoir – no project activities are planned within this PAC – remapping will occur following surveys.
PLA0067	**0**	**2**	**62**	Insufficient nesting/roosting habitat within 1.5 miles of activity center (see map)
PLA0109	**0**	**0**	**26**	Insufficient nesting/roosting habitat within 1.5 miles of activity center (see map)
PLA0113	**7**	**7**	**131**	Private timberlands separate the 131 acres of nesting/roosting habitat on NFS from the current territory center by more than a mile.


King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC with Basal Area Mortality
Post-fire spotted owl PACs
Pre-fire spotted owl PACs not remapped
Four Category Percent Change
0% Basal Area Mortality
0% <= Basal Mortality < 25%
25% <= Basal Mortality <75%
Basal Mortality >= 75%
Project Area
National Forest Land
Other Ownership
0
2
4
Miles
4/24/2015



King Fire Restoration

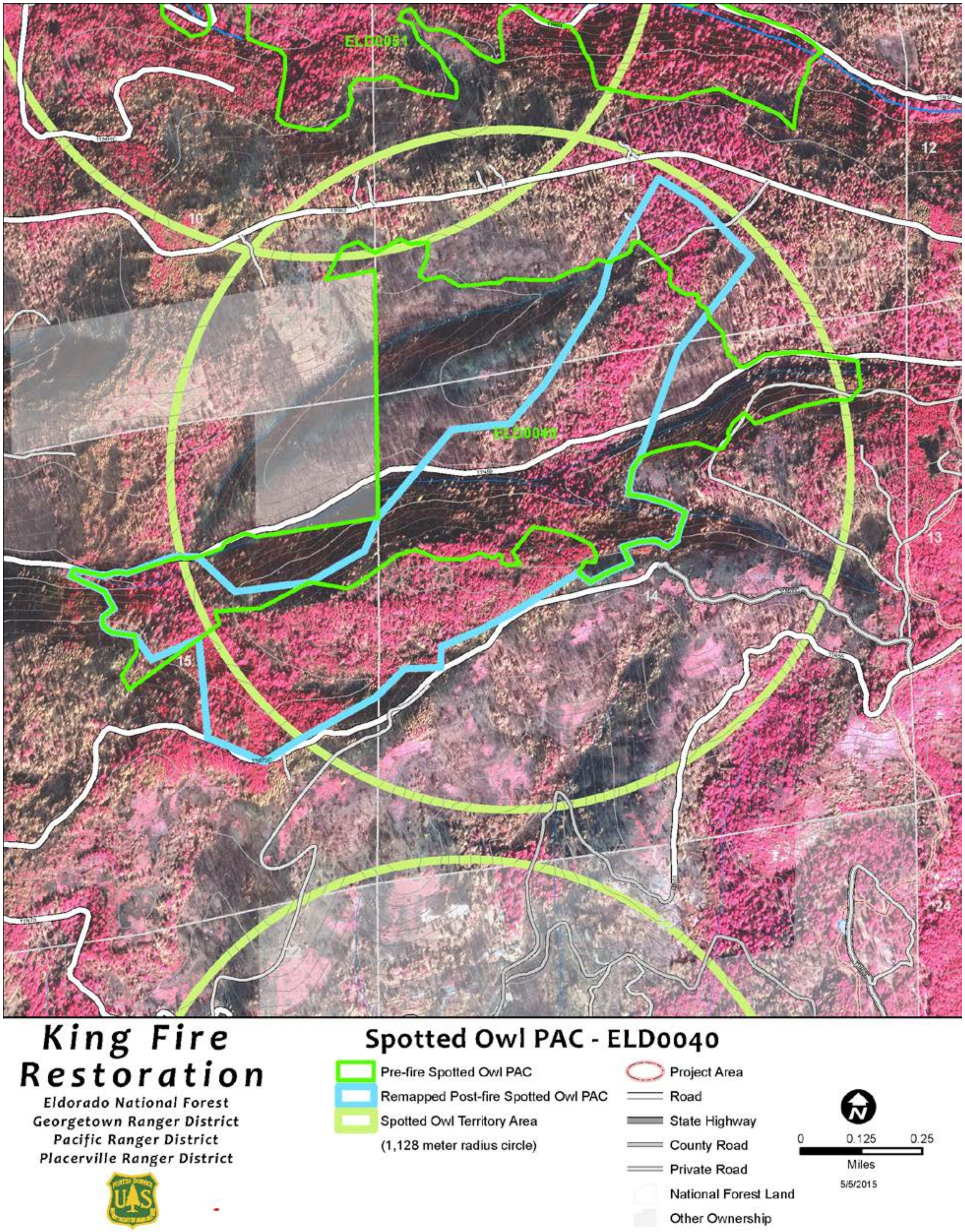
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District

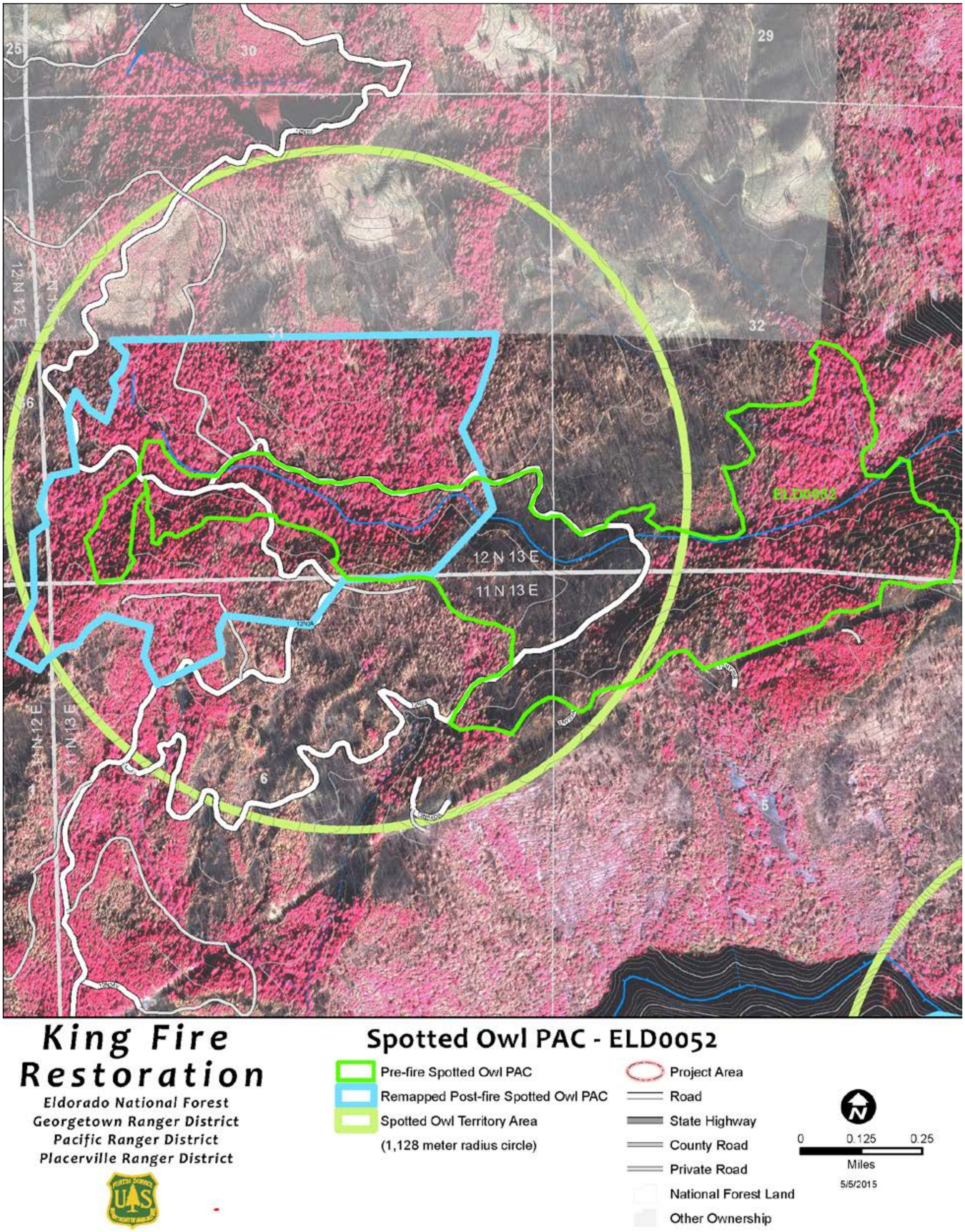
Spotted Owl PAC - ELD0036 & ELD0300

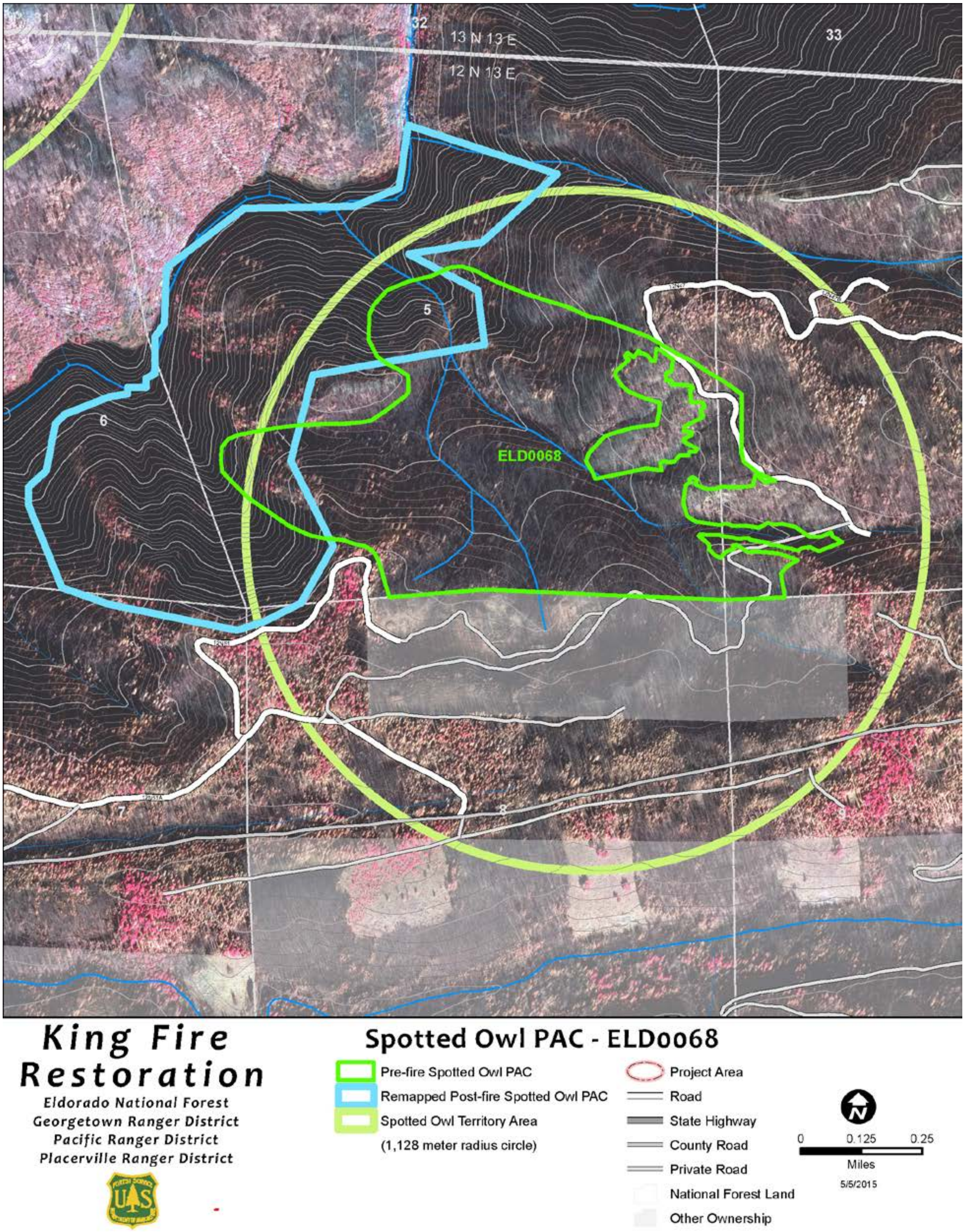
- Pre-fire Spotted Owl PAC
- Remapped Post-fire Spotted Owl PAC
- Spotted Owl Territory Area (1,128 meter radius circle)
- Project Area
- Road
- State Highway
- County Road
- Private Road
- National Forest Land
- Other Ownership

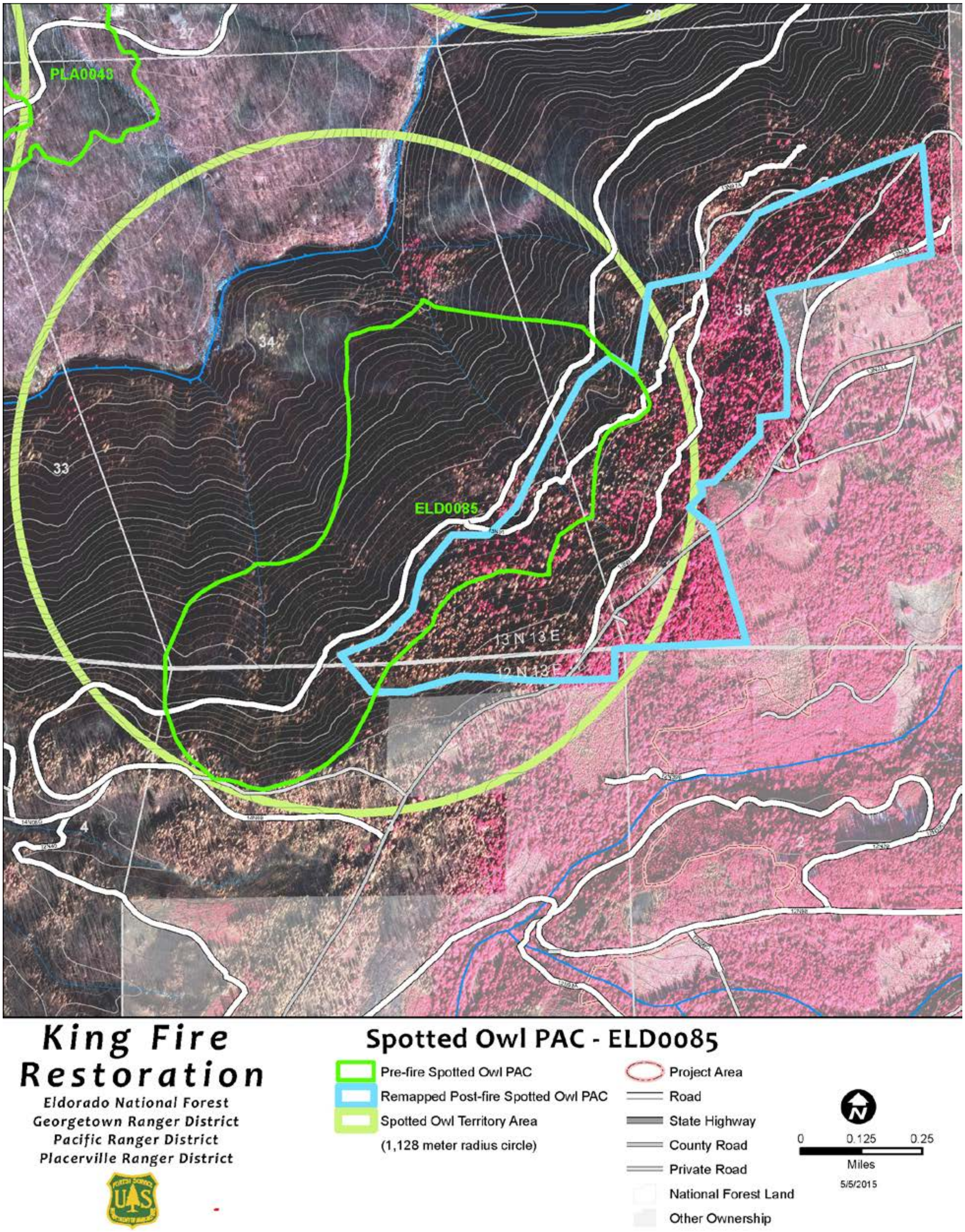
0 0.125 0.25
Miles

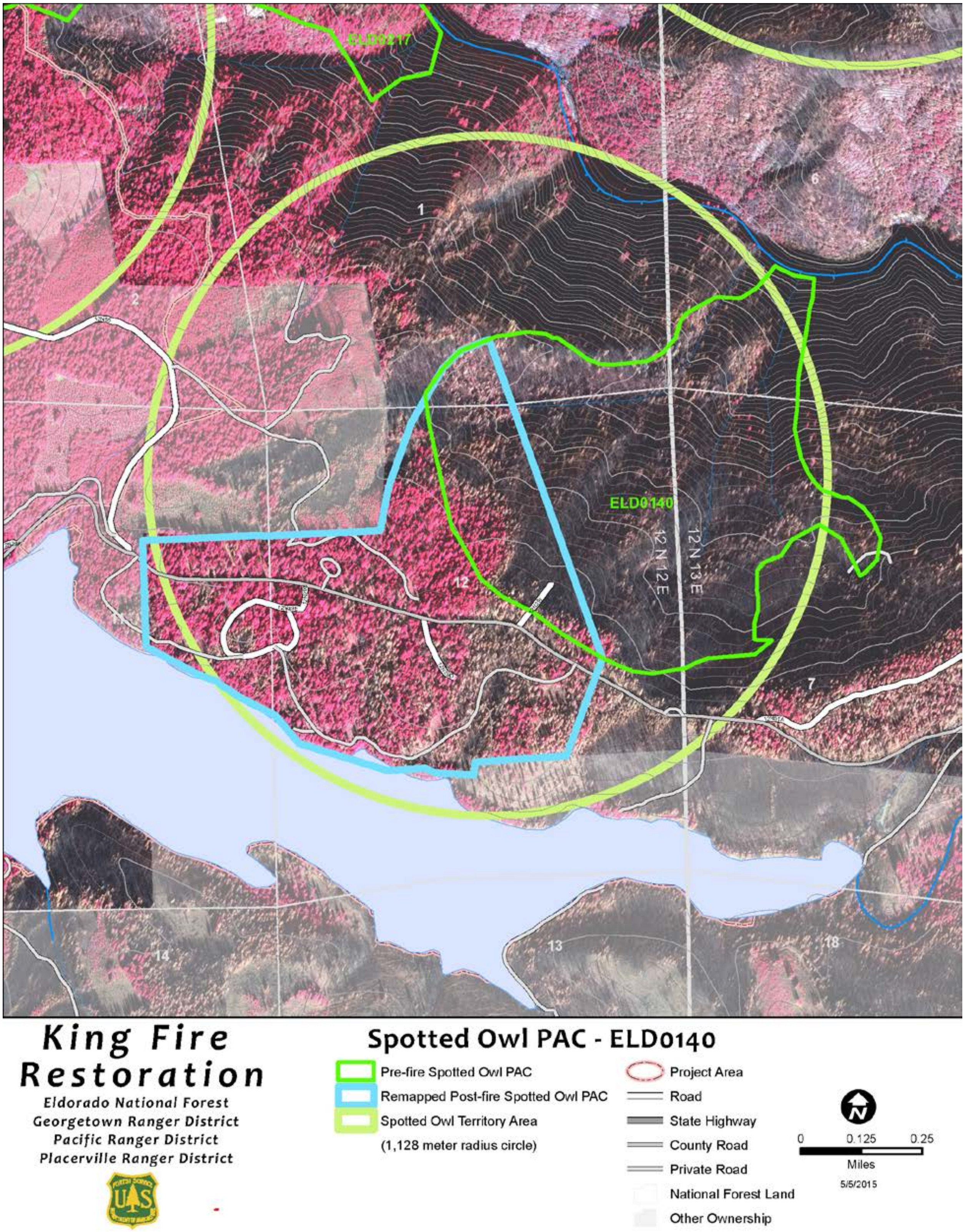
5/5/2015

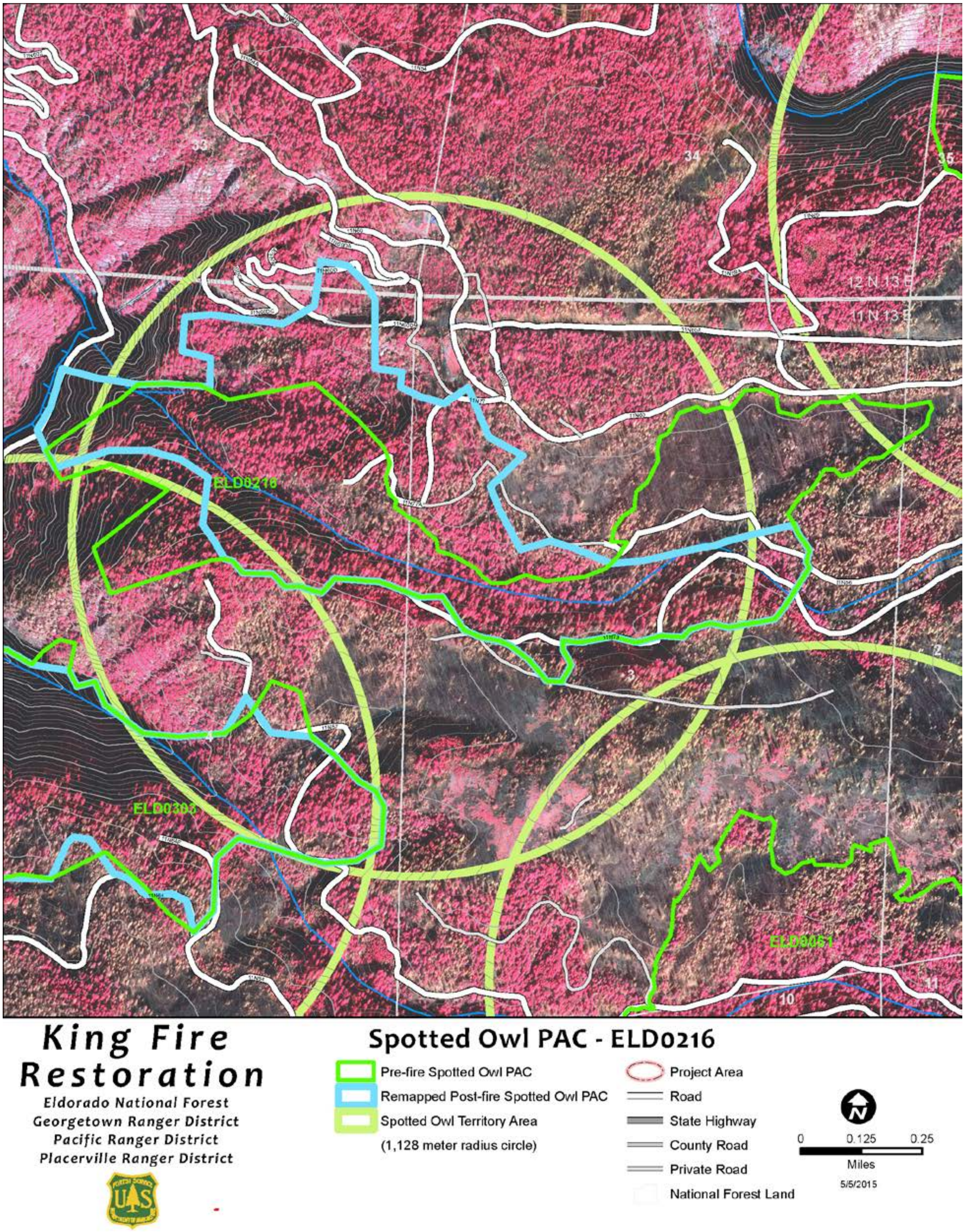

ELD0051
ELD0040
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - ELD0040
Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
0
0.125
0.25
Miles
5/5/2015

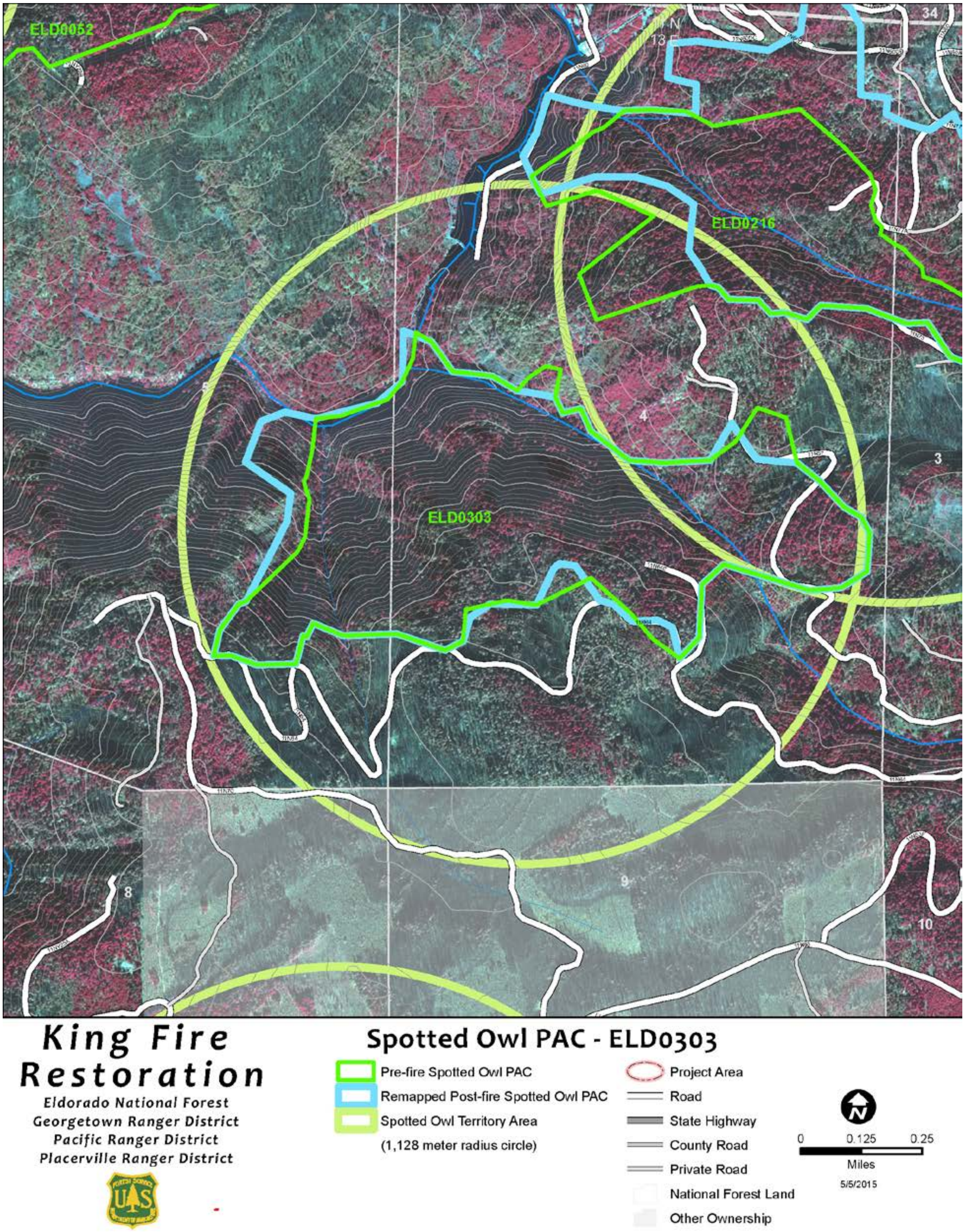

25
30
29
32
31
6
5
12 N 13 E
11 N 13 E
ELD0052
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - ELD0052
Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
0 0.125 0.25
Miles
5/5/2015

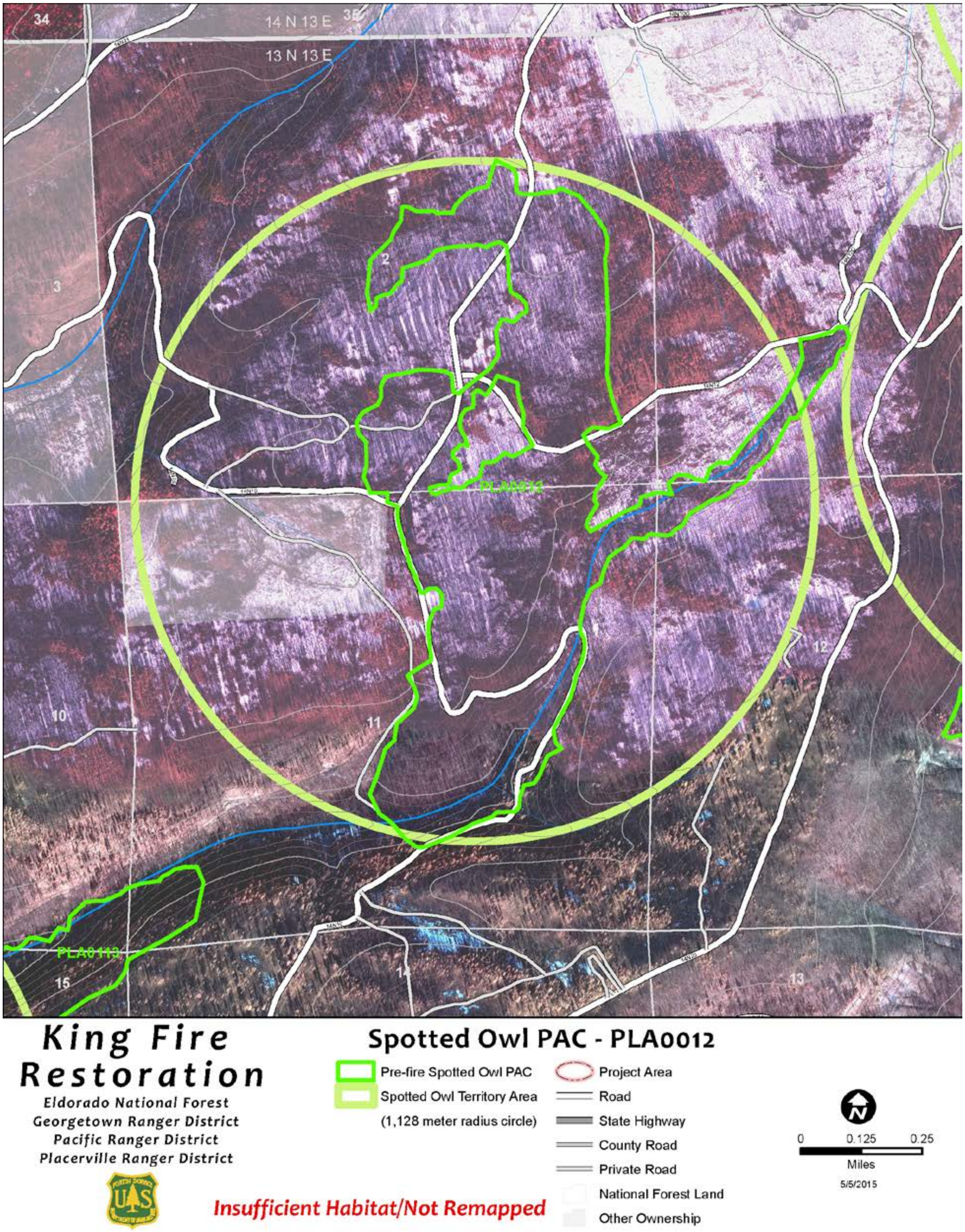

32
33
13 N 13 E
12 N 13 E
5
6
4
7
8
ELD0068
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - ELD0068
Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
0
0.125
0.25
Miles
5/5/2015

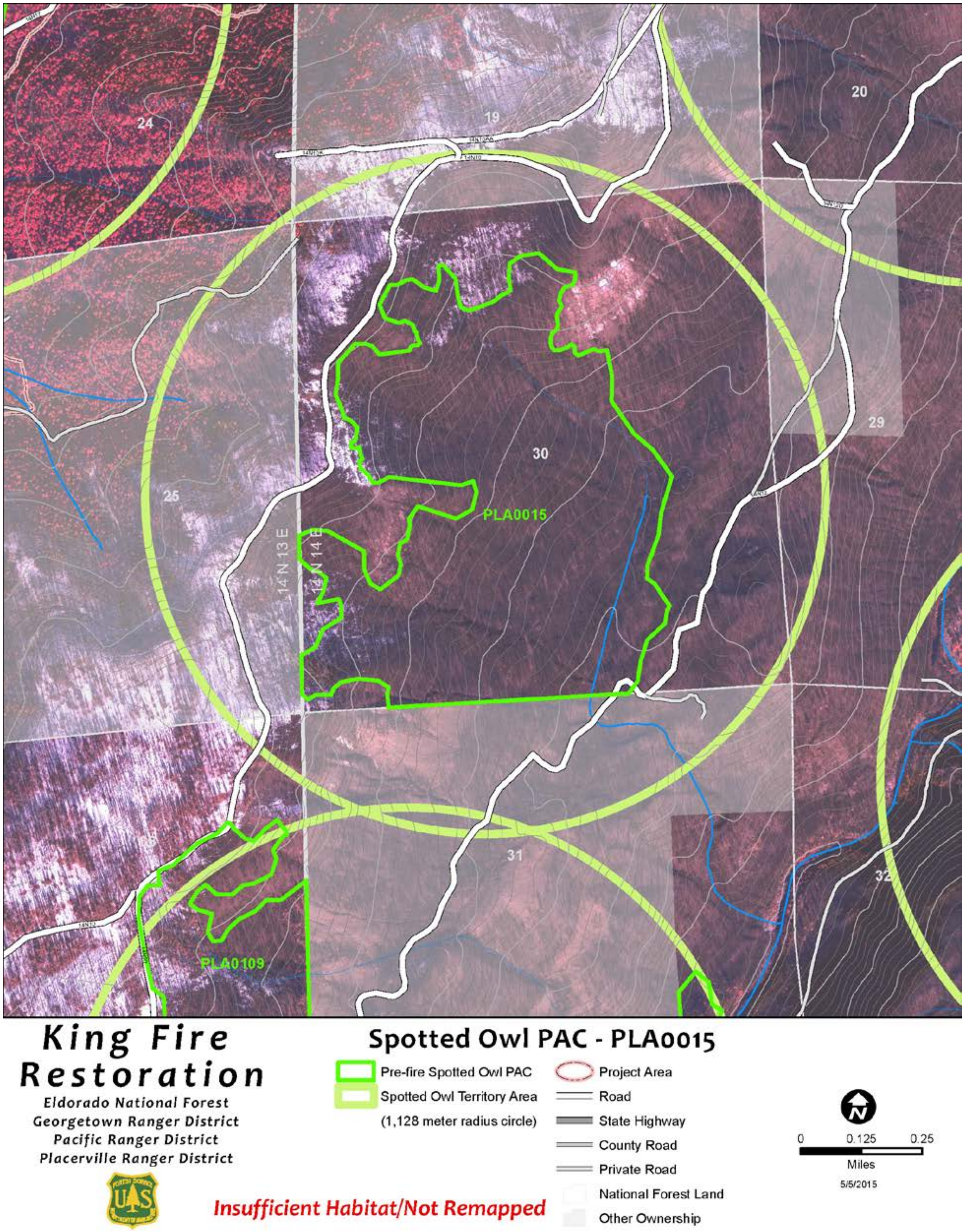

PLA0043
ELD0085
33
34
35
13 N 13 E
12 N 13 E
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - ELD0085
Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
0 0.125 0.25
Miles
5/5/2015


ELD0217
ELD0140
12N 12E
12N 13E
1
2
6
7
11
12
13
14
18
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - ELD0140
Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
0
0.125
0.25
Miles
5/5/2015


ELD0216
ELD0303
ELD0061
12 N 13 E
11 N 13 E
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - ELD0216
Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
0 0.125 0.25
Miles
5/5/2015


ELD0052
ELD0216
ELD0303
34
3
4
8
9
10
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - ELD0303
Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
0
0.125
0.25
Miles
5/5/2015


14 N 13 E
13 N 13 E
34
35
3
2
10
11
12
14
13
15
PLA0012
PLA0113
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - PLA0012
Pre-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
Insufficient Habitat/Not Remapped
0
0.125
0.25
Miles
5/5/2015


24
19
20
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29
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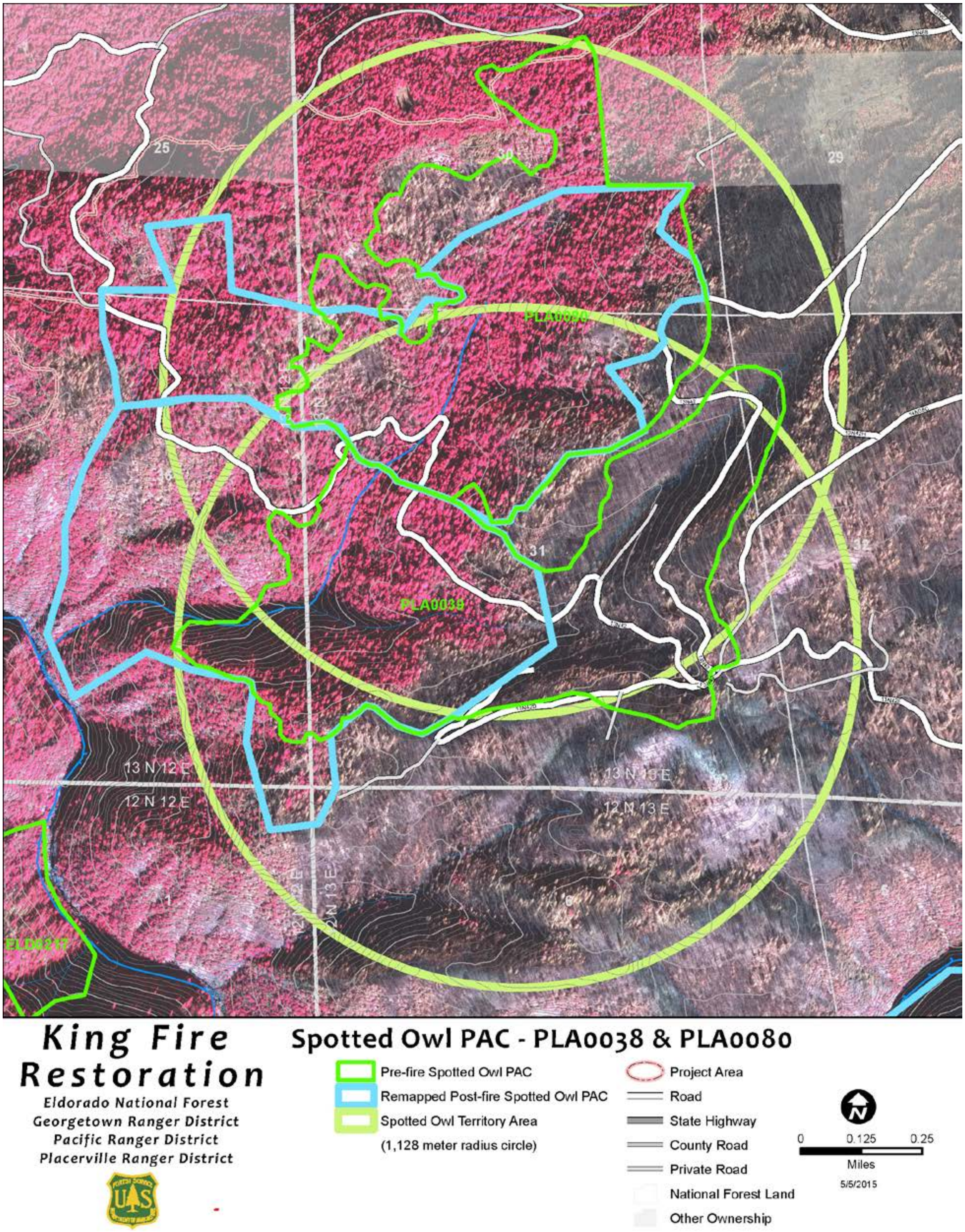
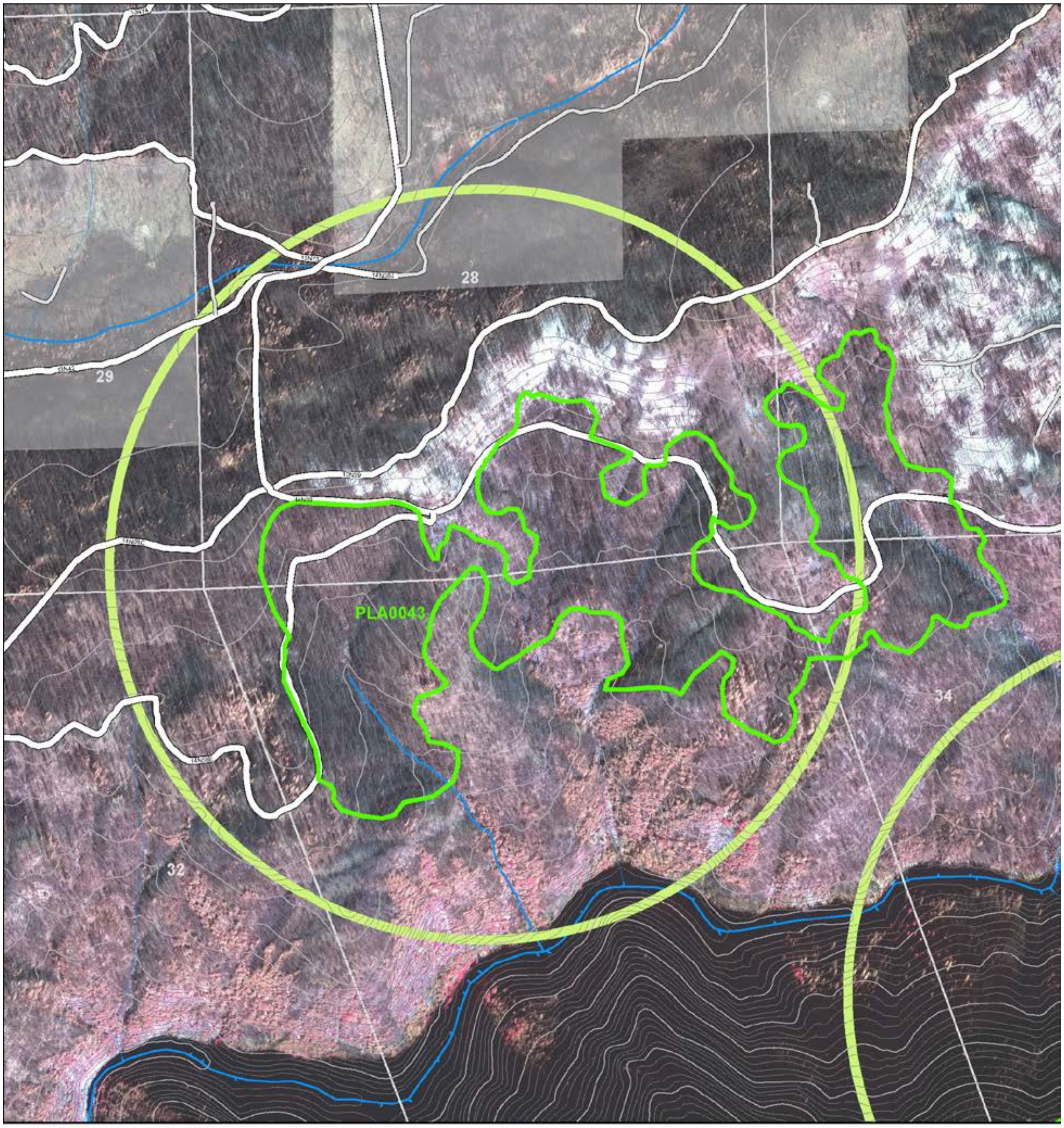
31
32
14 N 13 E
14 N 14 E
PLA0015
PLA0109
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - PLA0015
Pre-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
Insufficient Habitat/Not Remapped
0
0.125
0.25
Miles
5/5/2015


25
30
29
PLA0080
PLA0038
31
32
13 N 12 E
12 N 12 E
13 N 13 E
12 N 13 E
ELD0217
King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - PLA0038 & PLA0080
Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
0 0.125 0.25
Miles
5/5/2015



King Fire Restoration

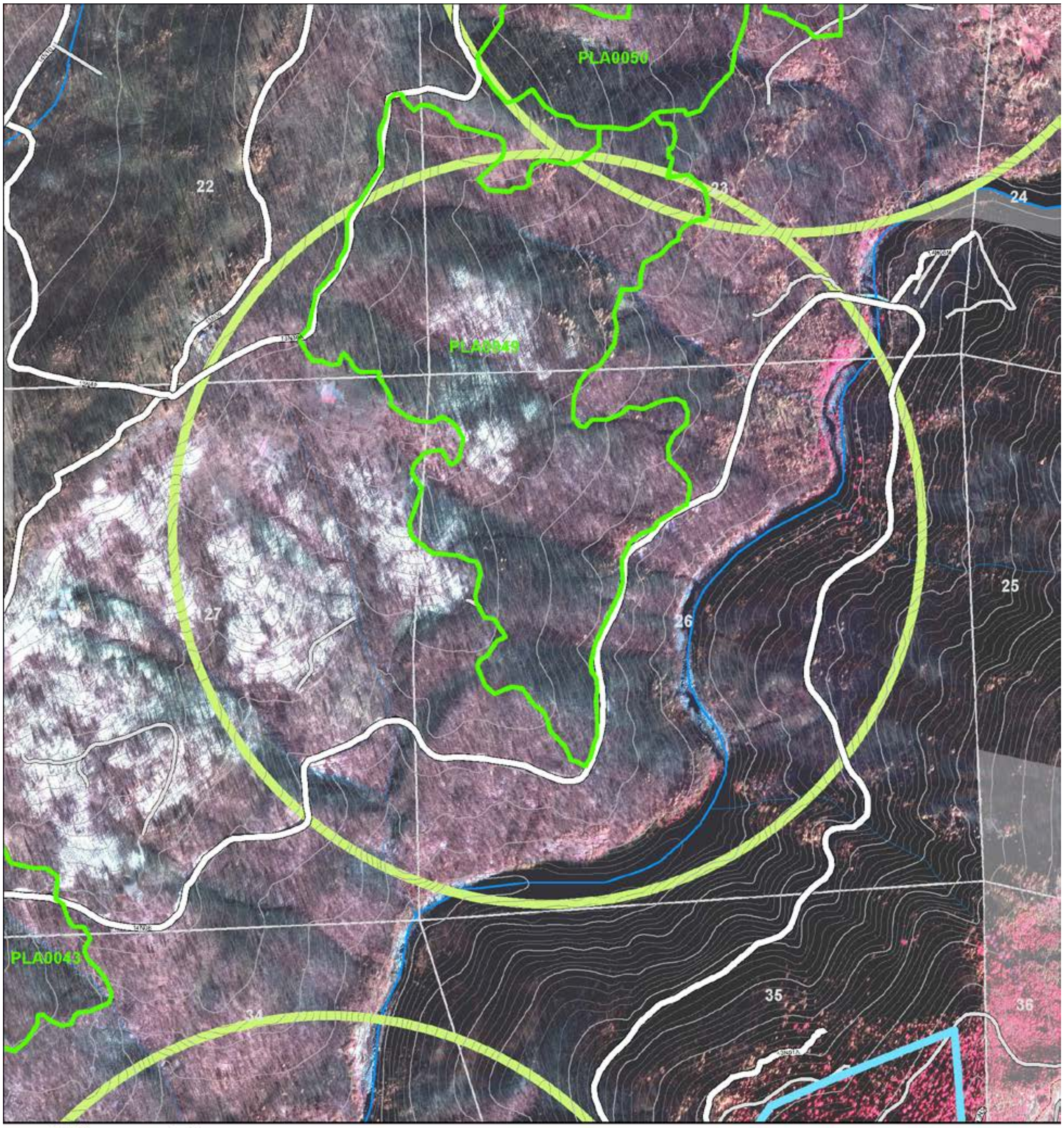
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District

Spotted Owl PAC - PLA0043

Pre-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership

0 0.125 0.25
Miles
5/5/2015

Insufficient Habitat/Not Remapped



King Fire Restoration

Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District

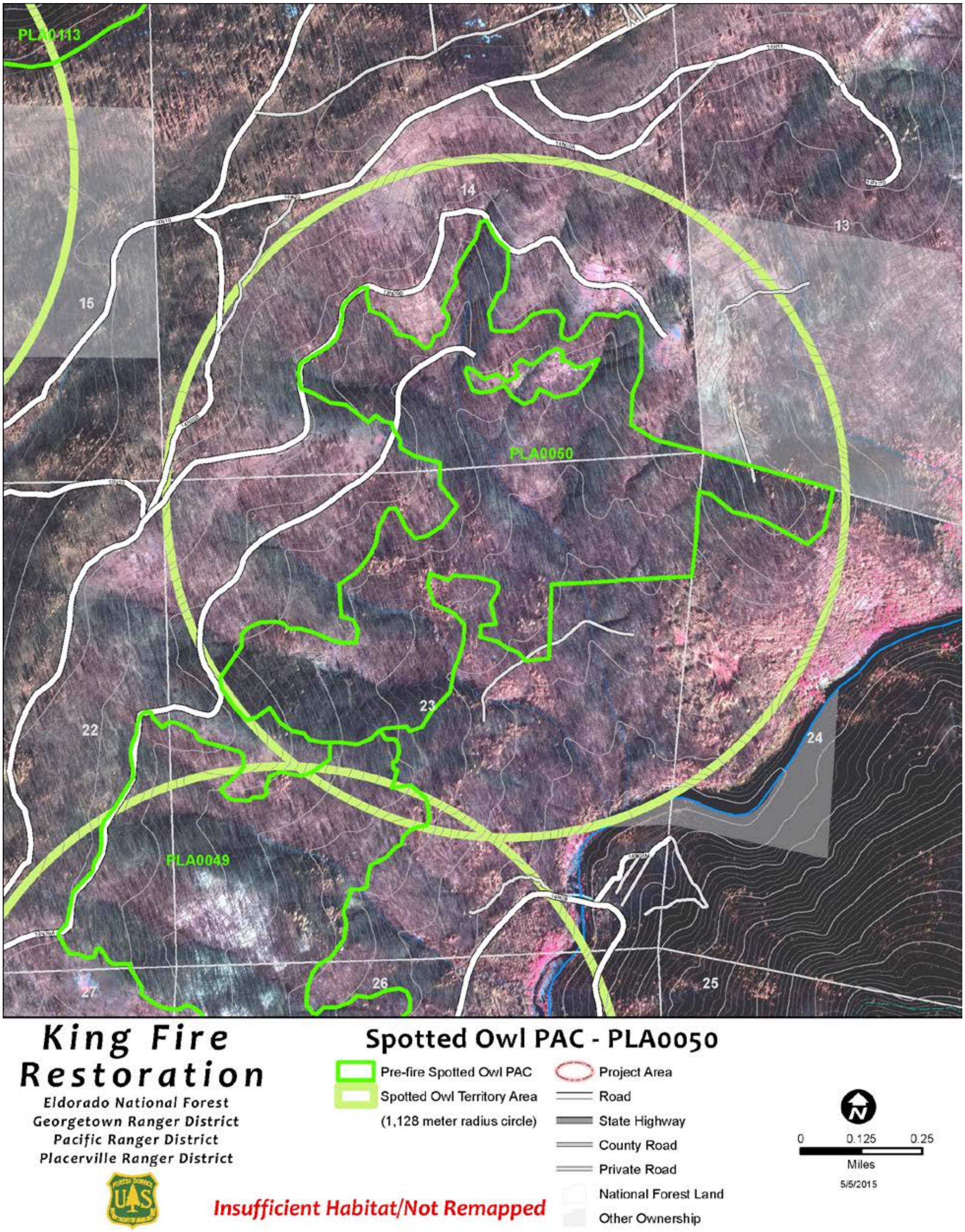
Spotted Owl PAC - PLA0049

Pre-fire Spotted Owl PAC
Remapped Post-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)

Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership

0 0.125 0.25
Miles
5/5/2015

Insufficient Habitat/Not Remapped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King Fire
Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - PLA0050
Pre-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
Insufficient Habitat/Not Remapped
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Miles
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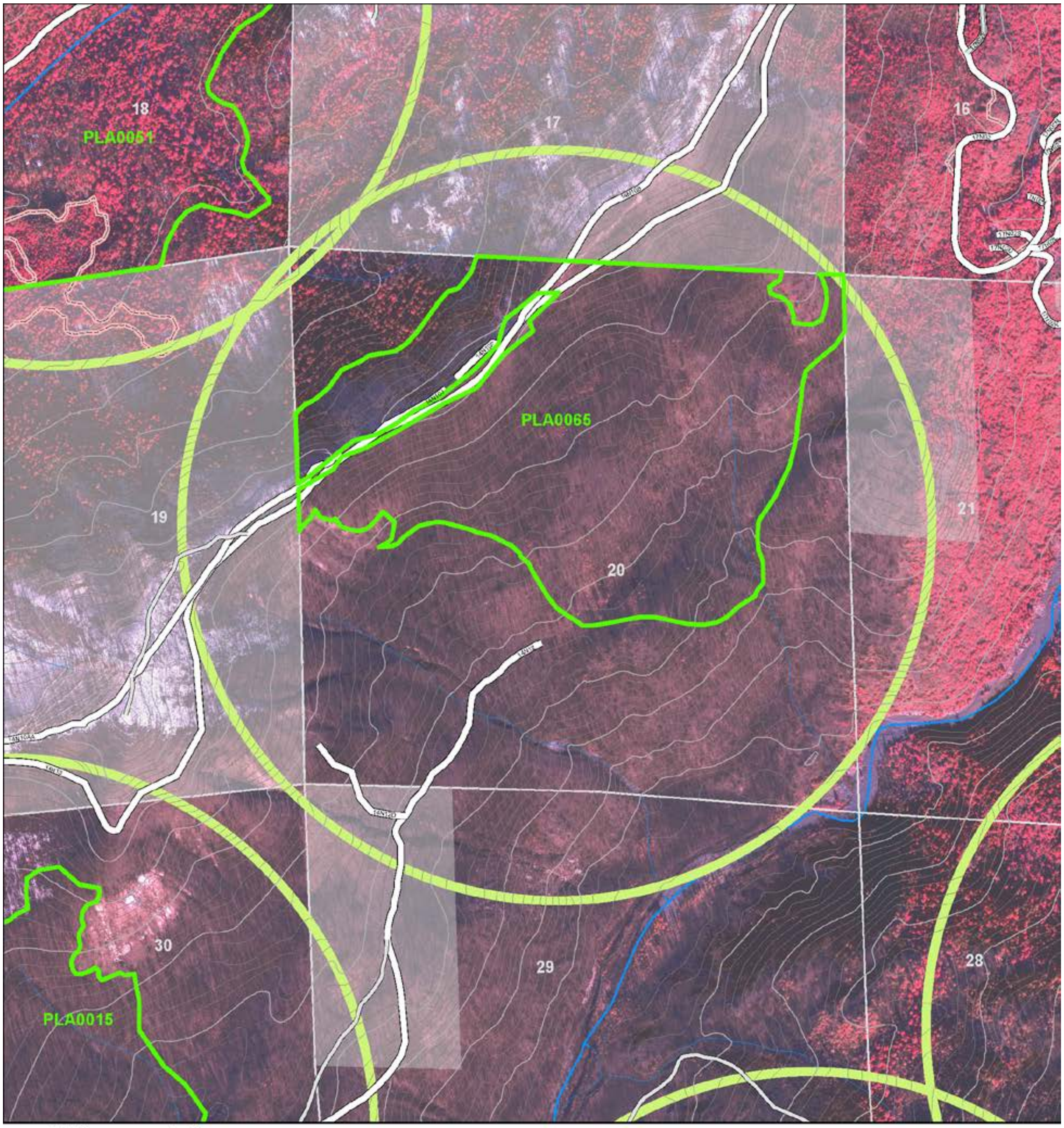

King Fire Restoration

Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District

Spotted Owl PAC - PLA0065

Pre-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)

Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership

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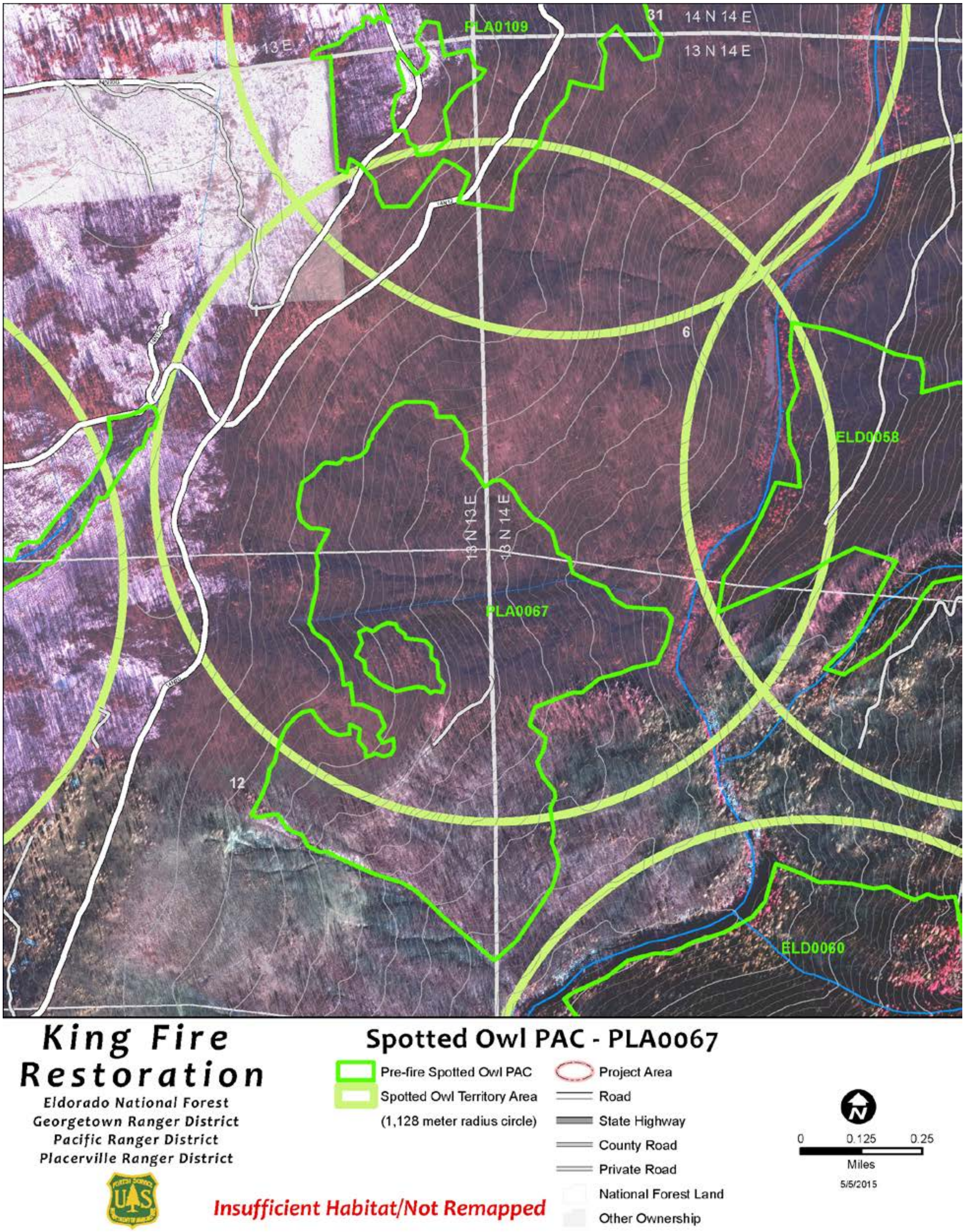
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King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Spotted Owl PAC - PLA0067
Pre-fire Spotted Owl PAC
Spotted Owl Territory Area
(1,128 meter radius circle)
Project Area
Road
State Highway
County Road
Private Road
National Forest Land
Other Ownership
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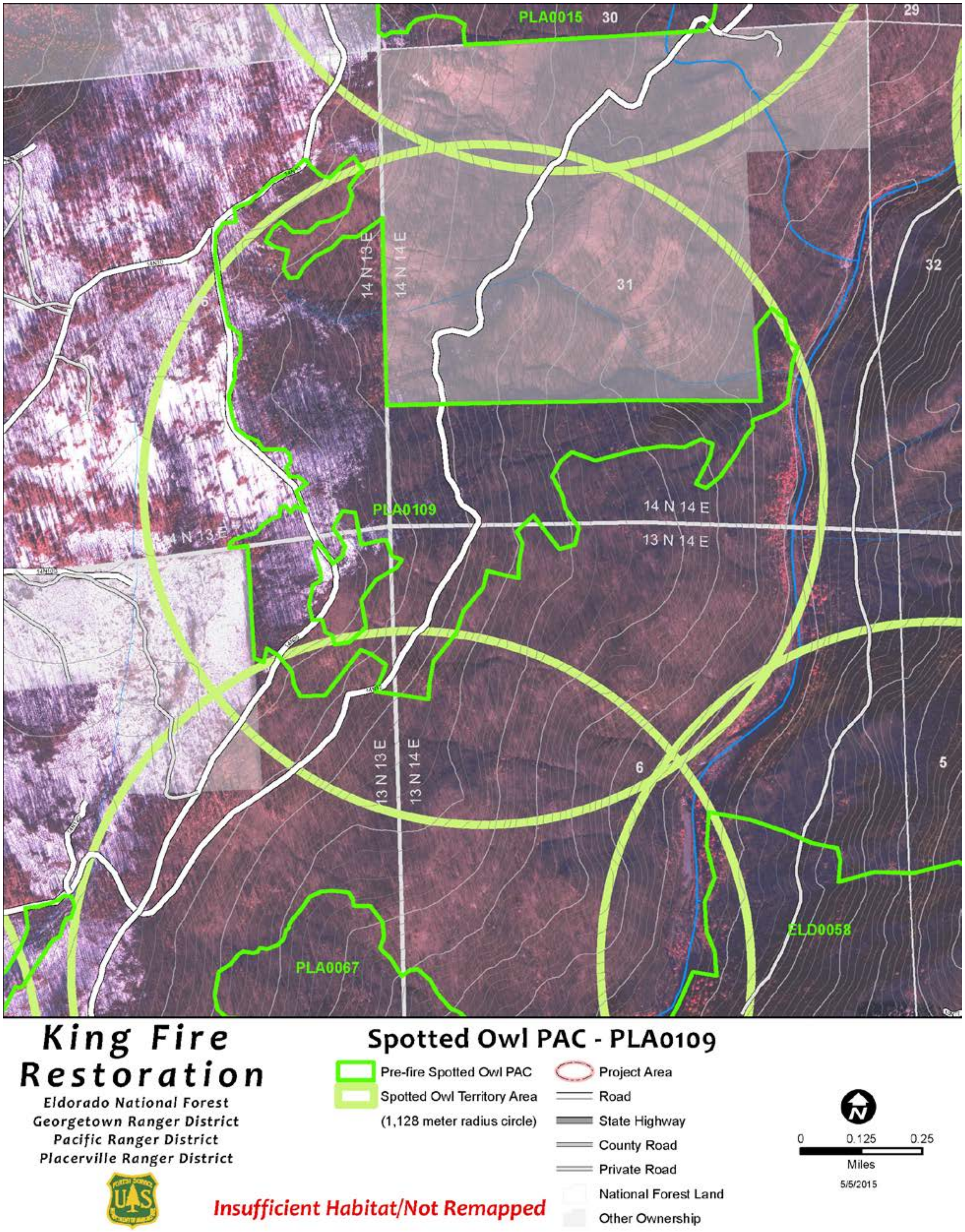
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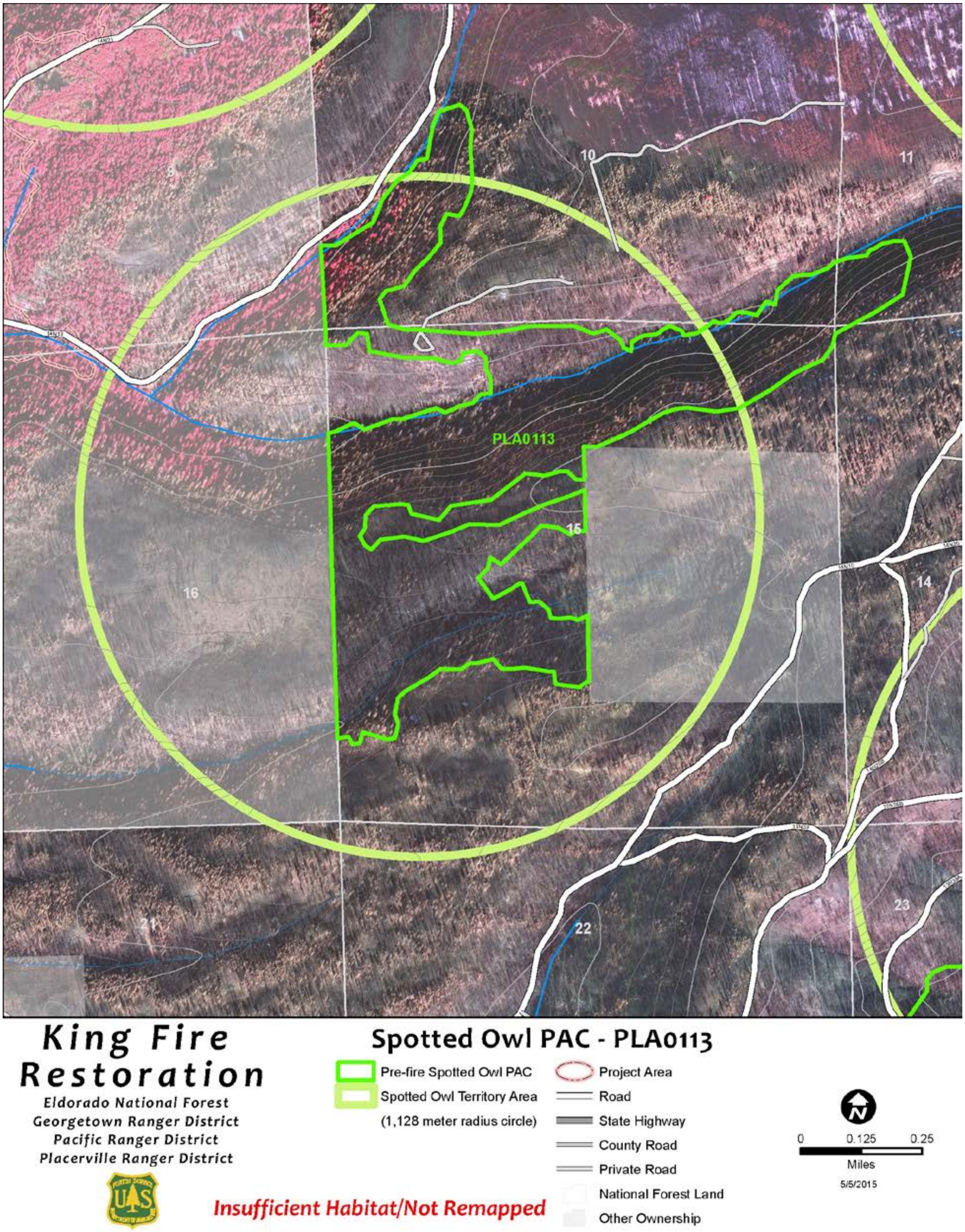
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King Fire Restoration
Eldorado National Forest
Georgetown Ranger District
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Placerville Ranger District
Spotted Owl PAC - PLA0113
Pre-fire Spotted Owl PAC
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Private Road
National Forest Land
Other Ownership
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0.125
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Miles
5/5/2015
Insufficient Habitat/Not Remapped

Appendix F: Best Management Practices

Table 6 – Region 5 Best Management Practices

In the following table, design criteria are coded as:

- RCA Riparian Conservation Areas
- AR Aquatic Resources
- WS Watershed
- WSA Watershed Sensitive Areas
- TSC Timber Sale Contract (provisions listed herein apply to corresponding provisions in stewardship contracts)
- FSH Forest Service Handbook
- FP-03 Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects

BMP Number	BMP Practice	BMP Objective	Project BMPs
12.12 Timber Management Best Management Practices			
1-1	Timber Sale Planning Process	To incorporate water quality and hydrologic considerations into the TSPP.	EIS Design Criteria: ▪ RCAs: 1 ▪ AR-6, 11, 13, 21 ▪ WS-1 through 7, and 9 through 12 TSC FSH 2409.13, Chap. 21-41 R-5 FSH 2409.26, Section 13 WSA development
1-2	Timber Harvest Unit Design	To ensure that timber harvest unit design will secure favorable conditions of water quality and quantity while maintaining desirable stream channel characteristics and watershed conditions. The design should consider the size and distribution of natural structures (snag and down logs) as a means of preventing erosion and sedimentation.	TSC Prov. C6.6 – R5 TSC Prov. C6.5 – R5 R5 Soil Quality Standards WSA development
1-3	Determination of Surface Erosion Hazard for Timber Harvest Unit Design	To identify high erosion hazard areas in order to adjust treatment measures to prevent downstream water quality degradation.	EHR analysis: Soil Section WSA development
1-4	Use of Sale Area Maps (SAM) and/or Project Maps for Designating Water Quality Protection Needs	To ensure recognition and protection of areas related to water quality protection delineated on a SAM or Project Map.	TSC Prov. B1.1 TSC Prov. B6.5 TSC Prov. B6.6 TSC Prov. C6.5 TSC Prov. C6.6

BMP Number	BMP Practice	BMP Objective	Project BMPs
1-5	Limiting the Operating Period of Timber Sale Activities	To ensure that the purchasers conduct their operations, including erosion control work, road maintenance, and so forth, in a timely manner, within the time specified in the Timber Sale Contract.	TSC Prov. B6.3 TSC Prov. B6.311 TSC Prov. B6.31 TSC Prov. B6.6 TSC Prov. B6.65 TSC Prov. B6.66 TSC Prov. C6.315 – R5
1-6	Protection of Unstable Lands	To provide special treatment of unstable areas to avoid triggering mass slope failure with resultant erosion and sedimentation. Minimum 50 feet Avoid headwall swale areas Avoid concave slopes Tighten up water bars Minimize surficial erosion Drain away from headwalls	Unstable areas were identified using LiDAR and flagged. The most unstable areas were identified as WSA to minimize erosion. Treatments in general include keeping skid trails 50 feet from flagged areas, drain skid trails away from flagged areas where feasible, and avoiding headwall swale areas.
1-7	Prescribing the Size and Shape of Regeneration Harvest Units	To control the physical size and shape of regeneration harvest units as a means of preventing erosion and sedimentation.	N/A: There are no regeneration harvest units.
1-8	Streamside Management Zone Designation	To designate a zone along riparian areas, streams, and wetlands that will minimize potential for adverse effects from adjacent management activities. Management activities within these zones are designed to improve riparian values.	EIS Design Criteria: ▪ RCAs: 1 ▪ AR-6, 11, 13, 21 ▪ WS-1 through 7, and 9 through 12 ▪ AR-13 TSC Prov. B6.5 TSC Prov. C6.5 – R5 R5 FSH 2409.26 Sec. 12 and 13 R5 FSH 2409.15, Sec. 61.41
1-9	Determining Tractor Loggable Ground	To minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.	Slope limitations and buffers FSH 2509.15 Soil Section
1-10	Tractor Skidding Design	By designing skidding patterns to best fit the terrain, the volume, velocity, concentration, and direction of runoff, water can be controlled in a manner that will minimize erosion and sedimentation.	EIS Design Criteria: ▪ RCAs: 1 ▪ WS-2 and 9. Existing disturbances were identified using LiDAR.

BMP Number	BMP Practice	BMP Objective	Project BMPs
1-11	Suspended Log Yarding in Timber Harvesting	1. To protect the soil mantle from excessive disturbance. 2. To maintain the integrity of the SMZ and other sensitive watershed areas. 3. To control erosion on cable corridors.	R-5 FSH 2409.15 Sec. 61 TSC Prov. B6.42 TSC Prov. C6.425 TSC Prov. C6.429
1-12	Log Landing Location	To locate new landings or reuse old landings in such a way as to avoid watershed impacts and associated water quality degradation.	R-5 FSH 2409.15 Sec. 61 EIS Design Criteria: ▪ RCAs: 1 ▪ WS-9 TSC Prov. B6.422 TSC Prov. C6.428 TSC Prov. C6.6
1-13	Erosion Prevention and Control Measures During Timber Sale Operations	To ensure that the purchasers' operations will be conducted reasonably to minimize soil erosion.	R-5 FSH 2409.15 Sec. 61 TSC Prov. B6.3 TSC Prov. B6.6 TSC Prov. C6.6 – R5
1-14	Special Erosion-prevention Measures on Disturbed Land	To provide appropriate erosion and sedimentation protection for disturbed areas.	EIS Design Criteria: ▪ WS-3, 4, 6, 7, 8, 9, 11, and 12 ▪ Development of WSAs R-5 FSH 2409.15 Sec. 61 FSH 2509.11 TSC Prov. B6.6 TSC Prov. C6.6 – R5
1-15	Revegetation of Areas Disturbed by Harvest Activities	To establish a vegetative ground cover on disturbed sites to prevent erosion and sedimentation.	BMP 2-13: An erosion control plan will be developed prior to implementation.
1-16	Log Landing Erosion Control	To reduce the impacts of erosion and subsequent sedimentation associated with log landings by use of mitigating measures.	R-5 FSH 2409.15 Sec. 61 TSC Prov. B6.422 TSC Prov. B6.64 TSC Prov. B6.6 TSC Prov. B6.67 TSC Prov. C6.428 TSC Prov. C6.6 - R5
1-17	Erosion Control on Skid Trails	To protect water quality by minimizing erosion and sedimentation derived from skid trails.	EIS Design Criteria: ▪ RCA-1 ▪ WS-2, 3, and 9 R-5 FSH 2409.15 Sec. 61 TSC Prov. B6.6 TSC Prov. B6.65 TSC Prov. B6.66 TSC Prov. C6.6 - R5

BMP Number	BMP Practice	BMP Objective	Project BMPs
1-18	Meadow Protection During Timber Harvesting	To avoid damage to the ground cover, soil, and the hydrologic function of meadows.	N/A: No activities will occur in identified meadows and fens.
1-19	Streamcourse and Aquatic Protection	1. To conduct management actions within these areas in a manner that maintains or improves riparian and aquatic values. 2. To provide unobstructed passage of storm flows. 3. To control sediment and other pollutants entering stream courses. 4. To restore the natural course of any stream as soon as practicable, where diversion of the stream has resulted from timber management activities.	EIS Design Criteria: ▪ Development of WSAs ▪ RCA-1 ▪ AR-2, 6, 9, 10, 11 and 13 ▪ WS 1, 3, 4, 6, 11, and 12 R-5 FSH 2409.15 Sec. 51, 61 R-5 FSH 2409.26, Sec. 13 R-5 FSH 2509.22, Chap. 30 TSC Prov. B6.34 TSC Prov. B6.341 TSC Prov. B6.342 TSC Prov. B6.5 TSC Prov. B6.6 TSC Prov. C6.5 TSC Prov. C6.6
1-20	Erosion Control Structure Maintenance	To ensure that constructed erosion control structures are stabilized and working.	TSC Prov. B4.225 TSC Prov. B6.6 TSC Prov. B6.66 TSC Prov. B6.67
1-21	Acceptance of Timber Sale Erosion Control Measures Before Sale Closure	To ensure the adequacy of required erosion control work on timber sales.	R-5 FSH 2409.15 Sec. 61 TSC Prov. B6.36 TSC Prov. B6.6 TSC Prov. B6.63 TSC Prov. B6.64 TSC Prov. B6.65 TSC Prov. B6.66 TSC Prov. B9.5 TSC Prov. C6.6 – R5
1-22	Slash Treatment in Sensitive Areas	To maintain or improve water quality by protecting sensitive areas from degradation which would likely result from using mechanized equipment for slash disposal.	R5 FSH 2409.15 Sec. 61 TSC Prov. C6.7 – R5
1-23	Five-Year Reforestation Requirement	To assure a continuous forest cover and to limit disturbance on areas with limited regeneration potential where there is no assurance that the site can be reforested within the timeframe.	EIS: Reforestation proposal FSH 2409.13, Chap. 21 and 42 FSH 2409.26, Sec. 12 & 13 FSM 2470.3

BMP Number	BMP Practice	BMP Objective	Project BMPs
1-24	Non-recurring "C" Provisions that can be used for Water Quality Protection	To use the option of inserting Special "C" provisions in the timber sale contract to protect water quality where standard "B" or "C" provisions do not apply or are inadequate to protect watershed values.	None identified as needed at this time.
1-25	Modification of the Timber Sale Contract	To modify the TSC if new circumstances, or conditions indicate that the timber sale will damage soil, water, or watershed values.	TSC Prov. B8.3 TSC Prov. B8.31 TSC Prov. B8.33 FSH 2409.15, Sec. 33
12.22 Road and Building Site Construction Best Management Practices			
2-1	Travel Management Planning and Analysis	Roads impact water quality to varying degrees. Use the travel analysis and road management planning processes to develop measures to avoid, minimize, and mitigate adverse impacts to water, aquatic, and riparian resources during road management activities, contribute toward restoration of water quality where needed, and identify the road system which can be effectively maintained.	During field surveys, roads causing environmental degradation were identified. A Transportation Analysis for this project will be completed as part of the Transportation Report. A review and design of roads for installation and repair of water drainage features, culvert replacement and cleaning and road resurfacing activities is completed as part of the road engineering package and will be included in the Timber Sale Contract.
2-2	General Guidelines for the Location and Design of Roads	Locate roads to minimize problems and risks to water, aquatic, and riparian resources. Incorporate measures that prevent or reduce impacts, through design for construction, reconstruction, and other route system improvements.	No new permanent roads are proposed. Road Reconstruction/repair: FP-03 Special Project Specifications TSC: Prov. B5.211; Drawings TSC Prov. B5.1 TSC Prov. B5.12 TSC Prov. B5.2 Temporary Roads: TSC Prov. B5.1 TSC Prov. B6.63 TSC Prov. B6.631

BMP Number	BMP Practice	BMP Objective	Project BMPs
2-3	Road Construction and Reconstruction	Minimize erosion and sediment delivery from roads during road construction or reconstruction and their related activities.	Erosion Control Plan (not yet completed) FP-03 Special Project Specifications TSC: Prov. B5.211; Drawings TSC Prov. B6.6 TSC Prov. B6.63 TSC Prov. B6.66 TSC Prov. B6.67 TSC Prov. C6.6 – R5
2-4	Road Maintenance and Operations	To ensure water quality protection by providing adequate and appropriate maintenance and by controlling road use and operations.	Timber Sale Road Maintenance Specifications EIS Proposed Action ▪ Roads TSC Prov. B5.3 TSC Prov. C5.31
2-5	Water Source Development and Utilization	To supply water for road construction, maintenance, dust abatement, fire protection, and other management activities, while protecting and maintaining water quality.	Water sources were evaluated by an aquatics biologist for this project. EIS Design Criteria: ▪ AR-17 through 21 FP-03 Special Project Specifications TSC: Prov. B5.211; Drawings TSC Prov. C5.31 TSC Prov. C5.35 – R5
2-6	Road Storage	Ensure that roads placed in storage are maintained to so that drainage facilities and runoff patterns function properly, and damage to adjacent resources is prevented. Stored roads are managed to be returned to service, at various intervals.	FSM 7720 FSH 7709.56, Chap. 10 FP-03

BMP Number	BMP Practice	BMP Objective	Project BMPs
2-7	Road Decommissioning	Stabilize, restore, and vegetate unneeded roads to a more natural state as necessary to protect and enhance NFS lands, resources, and water quality. The end result is that the decommissioned road will not represent a significant impact to water quality by: 1. reducing erosion from road surfaces and slopes and related sedimentation of streams; 2. reducing risk of mass failures and subsequent impact on water quality; 3. restoring natural surface and subsurface drainage patterns; and 4. restoring stream channels at road crossings and where roads run adjacent to	No roads are proposed for decommissioning; however, identification and stabilization of priority disturbances are planned EIS Proposed Action ▪ Watershed Sensitive Areas EIS Design Criteria: ▪ WS-3, 4, 6, 7 and 9
2-8	Stream Crossings	Minimize water, aquatic, and riparian resource disturbances and related sediment production when constructing, reconstructing, or maintaining temporary and permanent water crossings.	FSH 2409.15 Sec. 51, 61 EIS Design Criteria ▪ AR-2 and 6 Timber Sale Road Maintenance Specifications Standard Specifications for Roads and Bridges Special Project Specifications TSC: Prov. B5.211; Drawings TSC Prov. B6.5 TSC Prov. B6.6 TSC Prov. B6.63 TSC Prov. B6.66 TSC Prov. B5.3 TSC Prov. C5.31 TSC Prov. C6.5 – R5 TSC Prov. C6.6 – R5
2-9	Snow Removal and Storage	Prevent or reduce erosion, sedimentation, and chemical pollution that may result from snow removal and storage activities.	Timber Sale Road Maintenance Specifications TSC Prov. B5.31 TSC Prov. B5.35 – R5
2-10	Parking and Staging Areas	Construct, install, and maintain an appropriate level of drainage and runoff treatment for parking and staging areas to protect water, aquatic, and riparian resources.	FSH 2409.15 Sec. 61 Typically landings. Refer to BMP 1-16

BMP Number	BMP Practice	BMP Objective	Project BMPs
2-11	Equipment Refueling and Servicing	Prevent fuels, lubricants, cleaners, and other harmful materials from discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources.	TSC Prov. B6.34 TSC Prov. B6.341 TSC Prov. B6.342
2-12	Aggregate Borrow Areas	Minimize disturbance to water, aquatic, and riparian resources when developing and using aggregate borrow sites.	N/A: No borrow pits will be used in the project area.
2-13	Erosion Control Plan	Effectively limit and mitigate erosion and sedimentation from any ground-disturbing activities, through planning prior to commencement of project activity, and through project management and administration during project implementation.	Erosion Control Plan will be developed prior to commencement of project. Wet Weather Project Plan developed and agreed to prior to operations outside normal operating season
12.31 Mining BMPs			No Mining Best Management Practices apply to this Project
12.41 Recreation BMPs			No Recreation Best Management Practices apply to this project
12.52 Vegetation Manipulation Best Management Practices			
5-1	Soil-disturbing Treatments on the Contour	To decrease sediment production and stream turbidity, while mechanically treating slopes.	EIS Design Criteria: ▪ WS: 1 through 7, 9 through 12
5-2	Slope Limitations for Mechanical Equipment Operation	To reduce gully and sheet erosion and associated sediment production by limiting tractor use.	EIS Proposed Action: ▪ WSA development EIS Design Criteria: ▪ WS-5 TSC Prov. C6.42 Stewardship project specifications; IRTC Prov. K-G.9
5-3	Tractor Operation Limitation in Wetlands and Meadows	To limit turbidity and sediment production resulting from compaction, rutting, runoff concentration, and subsequent erosion by excluding the use of mechanical equipment in wetland and meadows except for the purpose of restoring wetland and meadow function.	N/A: No activities are planned within wetlands or meadows Meadows are identified on contract map for avoidance/ protection; TSC Prov. B6.61

BMP Number	BMP Practice	BMP Objective	Project BMPs
5-4	Revegetation of Surface-disturbed Areas	To protect water quality by minimizing soil erosion through the stabilizing influence of vegetation foliage and root network.	EIS Proposed Action ▪ WSA development TSC Prov. C6.6 – R5
5-5	Disposal of Organic Debris	To prevent gully and surface erosion with associated reduction in sediment production and turbidity during and after treatment.	EIS Purpose and Need to reduce the risk to soils in future fires. EIS Proposed Action ▪ WSA development EIS Design Criteria: ▪ WS-1-12
5-6	Soil Moisture Limitations for Mechanical Equipment Operations	To prevent compaction, rutting, and gullying, with resultant sediment production and turbidity.	Wet Weather Project Plan developed and agreed to prior to operations outside normal operating season TSC Prov. B6.31 TSC Prov. B6.6 TSC Prov. B6.66 TSC Prov. C6.6 – R5
5-7	Pesticide Use Planning Process	To introduce water quality and hydrologic considerations into the pesticide use planning process.	EIS Design Criteria: ▪ AR-9 through 11
5-8	Pesticide Application According to Label Directions and Applicable Legal Requirements	To avoid water contamination by complying with all label instructions and restrictions for use.	FSM 2150 and FSH 2109.14 EIS Human Health and Safety Risk Assessment in project file and Chapter 3 of EIS Applications method described in EIS
5-9	Pesticide Application Monitoring and Evaluation	1. To determine whether pesticides have been applied safely, restricted to intended target areas, and have not resulted in unexpected non-target effects. 2. To document and provide early warning of possible hazardous conditions resulting from possible contamination of water or other non-target areas by pesticides. 3. To determine the extent, severity, and possible duration of any potential hazard that might exist.	FSH 2109.14

BMP Number	BMP Practice	BMP Objective	Project BMPs
5-10	Pesticide Spill Contingency Planning	To reduce contamination of water by accidental pesticide spills.	FSH 2109.14
5-11	Cleaning and Disposal of Pesticide Containers and Equipment	To prevent water contamination resulting from cleaning, or disposal of pesticide containers.	FSH 2109.14 (40)
5-12	Streamside Wet Area Protection During Pesticide Spraying	To minimize the risk of pesticide inadvertently entering waters, or unintentionally altering the riparian area, SMZ, or wetland.	EIS Design Criteria: ▪ AR-9 through 11
5-13	Controlling Pesticide Drift During Spray Application	To minimize the risk of pesticide falling directly into water, or non-target areas.	FSH 2109.14
12.62 Fire Suppression and Fuels Best Management Practices			
6-1	Fire and Fuels Management Activities	To reduce public and private losses and environmental impacts which result from wildfires and/or subsequent flooding and erosion by reducing or managing the frequency, intensity, and extent of wildfire.	EIS Purpose and Need
6-2	Consideration of Water Quality in Formulating Fire Prescriptions	To provide for water quality protection while achieving the management objectives through the use of prescribed fire.	EIS Design Criteria: ▪ AR-13 ▪ WS-10
6-3	Protection of Water Quality from Prescribed Burning Effects	To maintain soil productivity, minimize erosion, and minimize ash, sediment, nutrients, and debris from entering water bodies.	EIS Design Criteria: ▪ AR-13 ▪ WS-10
6-4	Minimizing Watershed Damage from Fire Suppression Efforts	To avoid watershed damage in excess of that already caused by the wildfire.	N/A
6-5	Repair or Stabilization of Fire Suppression-related Watershed Damage	To stabilize all areas that have had their erosion potential significantly increased, or their drainage pattern altered by suppression-related activities.	N/A

BMP Number	BMP Practice	BMP Objective	Project BMPs
6-6	Emergency Rehabilitation of Watersheds Following Wildfires	Objective: To minimize as far as practicable: a. loss of soil and onsite productivity; b. overland flow, channel obstruction, and instability; and c. threats to life and property, both onsite and offsite.	N/A
12.72 Watershed Management Best Management Practices			
7-1	Watershed Restoration	To repair degraded watershed conditions, and improve water quality and soil	EIS Proposed Action: ▪ WSA development includes limited watershed restoration.
7-2	Conduct Floodplain Hazard Analysis and Evaluation	To avoid, where possible, the long- and short-term adverse impacts to water quality associated with the occupancy and modification of floodplains.	N/A: No activities are proposed within floodplains
7-3	Protection of Wetlands	To avoid adverse water-quality impacts associated with destruction, disturbance, or modification of wetlands.	N/A: Implementation of activities are not planned in wetlands.
7-4	Forest and Hazardous Substance Spill Prevention Control and Countermeasure (SPCC) Plan	To prevent contamination of waters from accidental spills.	An annual spill plan is maintained for project implementation reference and planning. The SPCC Plan is developed and maintained at the Forest level and is tiered to in the annual spill plan. TSC Prov. B6.341
7-5	Control of Activities under Special Use Permit	To protect surface and subsurface water quality from physical, chemical, and biological pollutants resulting from activities that are under special use permit.	N/A
7-6	Water Quality Monitoring	To collect representative water data to determine baseline conditions for comparison to established water quality standards that are related to beneficial uses for that particular watershed.	EIS Watershed Monitoring Plan

BMP Number	BMP Practice	BMP Objective	Project BMPs
7-7	Management by Closure to Use (Seasonal, Temporary, and Permanent)	To exclude activities that could result in damages to either resources or improvements, such as roads and trails, resulting in impaired water quality.	Seasonal Forest Closure Order Gates installed per Road Plans/Drawings on applicable Maintenance Level 1 Roads EIS Design Criteria: WS-8
7-8	Cumulative Offsite Watershed Effects	To protect the identified beneficial uses of water from the combined effects of multiple management activities which individually may not create unacceptable effects but collectively may result in degraded water quality conditions.	EIS: Cumulative Watershed Effects analysis
12.81 Range Management BMPs			No Range Management BMPs are necessary for this project

Table 7 – National Best Management Practices Applicable To and Used in Project Planning and Design

BMP	Objective	Compliance
Plan-1. Forest and Grassland Planning	Use the land management planning and decision-making processes to incorporate direction for water quality management consistent with laws, regulation, and policy into land management plans.	Applicable to Land Management Plan. Direction from the Land Management Plan is tiered in project planning and through Regional BMPs.
Plan-2. Project Planning and Analysis	Use the project planning, environmental analysis, and decision-making processes to incorporate water quality management BMPs into project design and implementation.	Interdisciplinary Team project planning and effects analysis. Analysis of Riparian Conservation Objectives (RCO). Regional BMPs (12.12 1-1; 12.22 2-1 and 2-13; 12.52 5-7)
Plan-3. Aquatic Management Zone Planning	To maintain and improve or restore the condition of land around and adjacent to waterbodies in the context of the environment in which they are located, recognizing their unique values and importance to water quality while implementing land and resource management activities.	RCO analysis and Interdisciplinary Team development of proposed action items for improvement of aquatic ecosystems including reduced fire hazard and transportation improvements. Regional BMP 12.12 1-19.
AqEco-1. Aquatic Ecosystem Improvement and Restoration Planning	Reestablish and retain ecological resilience of aquatic ecosystems and associated resources to achieve sustainability and provide a broad range of ecosystem services.	Identification of project activities such as transportation improvements and rehab of areas to improve hydrologic and aquatic functioning. RCO planning and analysis process.
AqEco-2. Operations in Aquatic Ecosystems	Avoid, minimize, or mitigate adverse impacts to water quality when working in aquatic ecosystems.	RCO analysis and Interdisciplinary team development of design criteria to protect aquatic ecosystems. Regional BMP 12.12 1-19.
AqEco-3. Ponds and Wetlands	Design and implement pond and wetlands projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources	Wetland improvements will occur as part of this project; however, this BMP will be addressed with specific designs (WSAs)
AqEco-4. Stream Channels and Shorelines	Design and implement stream channel and lake shoreline projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.	Channel projects will occur as part of this project; however, this BMP will be addressed with specific designs.

BMP	Objective	Compliance
Chem-1. Chemical Use Planning	Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.	RCO and ID Team involvement in action and design criteria development including nozzle requirements, buffer widths, and chemicals proposed. Project conformance with local, State, Federal, and agency policies, regulations, and laws through compliance with Regional BMP 12.52 5-9 and project design elements.
Chem-2. Follow Label Directions	Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.	Compliance with label requirements is built into compliance with Regional BMP 12.52 5-8 and project design.
Chem-3. Chemical Use Near Waterbodies	Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near waterbodies.	Proximity of application, mixing and storage of chemicals near waterbodies and identification of these areas evaluated and incorporated into the RCO and design criteria. Operation during weather conditions that could increase risk to aquatic and hydrologic resources have be restricted. Regional BMPs 12.52 5-10, and 5-12
Chem-4. Chemical Use in Waterbodies	Avoid, minimize, or mitigate unintended adverse effects to water quality from chemical treatments applied directly to waterbodies.	N/A. Waterbodies are not proposed for treatment under this project.
Chem-5. Chemical Handling and Disposal	Avoid or minimize water and soil contamination when transporting, storing, preparing and mixing chemicals; cleaning application equipment; and cleaning or disposing chemical containers.	Chemical handling and disposal is incorporated in this project through Regional BMP 5-11 compliance and FSH and FSM compliance.
Chem-6. Chemical Application Monitoring and Evaluation	1. Determine whether chemicals have been applied safely, have been restricted to intended targets, and have not resulted in unexpected non-target effects. 2. Document and provide early warning of possible hazardous conditions resulting from potential contamination of water or other non-target resources or areas by chemicals.	Monitoring of compliance and safety have been addressed in the design criteria and monitoring elements of the project. Regional BMP 5-9.

BMP	Objective	Compliance
Facilities and Non-recreation Special Uses BMPs (FAC 1-10)	The purpose of this set of BMPs is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from development, use, maintenance, and reclamation of facilities located on National Forest System lands.	N/A. Facility use and Special Uses are not included in this project.
Fire-1. Wildland Fire Management Planning	Use the fire management planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during wildland fire management activities.	N/A. Wildland fire management is not a part of this project.
Fire-2. Use of Prescribed Fire	Avoid, minimize, or mitigate adverse effects of prescribed fire and associated activities on soil, water quality, and riparian resources that may result from excessive soil disturbance, as well as inputs of ash, sediment, nutrients, and debris.	Design criteria and project design features including compliance with Regional BMPs 12.62 6-1, 6-2, and 6-3 has been developed to minimize potential for negative effects resulting from prescribed fire implementation.
Fire-3. Wildland Fire Control and Suppression	Avoid or minimize adverse effects to soil, water quality, and riparian resources during fire control and suppression efforts.	Not directly applicable to this project; however, with implementation of this project, potential for adverse effects from control and suppression of wildfire would be reduced.
Fire-4. Wildland Fire Suppression Damage Rehabilitation	Rehabilitate watershed features and functions damaged by wildland fire control and suppression-related activities to avoid, minimize, or mitigate long-term adverse effects to soil, water quality, and riparian resources	N/A. Not a fire rehabilitation project.
Minerals Management Activities (Min-1-8)	The purpose of this set of BMPs is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from various mineral exploration, development, operation, and reclamation activities.	N/A. Mineral management is not included in this project.
Rangeland Management Activities (Range-1-3)	The purpose of this set of BMPs is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from rangeland management activities.	N/A. Rangeland management is not included in this project

BMP	Objective	Compliance
Recreation Management Activities (Rec-1-2 and 4-12)	The purpose of this set of BMPs is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources that may result from recreation activities.	N/A. Recreation management is not included in this project except to include EIS Design Criteria: WS-8 to discourage unauthorized OHV use.
Rec-3. Dispersed Use Recreation	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by managing dispersed activities and undeveloped sites to maintain ground cover, maintain soil quality, control runoff, and provide needed sanitary facilities to minimize the discharge of nonpoint source pollutants and maintain streambank and riparian area integrity.	N/A. Control and rehabilitation of dispersed recreation sites is not included in proposed activities for this project except to include EIS Design Criteria: WS-8 to discourage unauthorized OHV use.
Road-1. Travel Management Planning and Analysis	Use the travel management planning and analysis processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during road management activities.	Included in the NEPA ID Team analysis of the project.
Road-2. Road Location and Design	Locate and design roads to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources.	Design of roads was evaluated and planned as part of the ID Team process for project design. Regional BMP 12.22 2-1.
Road-3. Road Construction and Reconstruction	Avoid or minimize adverse effects to soil, water quality, and riparian resources from erosion, sediment, and other pollutant delivery during road construction or reconstruction.	Compliance with Regional BMP 2-3 and contract road package requirements.
Road-4. Road Operations and Maintenance	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling road use and operations and providing adequate and appropriate maintenance to minimize sediment production and other pollutants during the useful life of the road.	Regional BMP 12.22 2-3. Maintenance and appropriate use of roads used during the project is built into the timber sale and stewardship contracts.
Road-5. Temporary Roads	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of temporary roads.	Temporary road construction, use, and management are dealt with through compliance with contract provisions for timber sale and stewardship projects and FSH 2409.15. Regional BMPs 12.22 2-2, and 2-8

BMP	Objective	Compliance
Road-6. Road Storage and Decommissioning	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by storing closed roads not needed for at least one year (Intermittent Stored Service) and decommissioning unneeded roads in a hydrologically stable manner to eliminate hydrologic connectivity, restore natural flow patterns, and minimize soil erosion.	Compliance with Regional BMPs (12.22 2-6 and 2-7) and contract provisions for a timber sale or stewardship contract. Additionally, opportunities for road decommissioning were reviewed as part of the ID Team planning and project design process.
Road-7. Stream Crossings	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing, reconstructing, or maintaining temporary and permanent waterbody crossings.	ID Team project design and evaluation for road work activities, project design criteria, and compliance with Regional BMP 12.22 2-8.
Road-8. Snow Removal and Storage	Avoid or minimize erosion, sedimentation, and chemical pollution that may result from snow removal and storage activities.	Compliance with Regional BMP 12.22 2-9 and contract provisions for a timber sale or stewardship contract.
Road-9. Parking and Staging Areas	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when constructing and maintaining parking and staging areas.	Compliance with Regional BMP 12.22 2-10. Parking and staging is usually connected to landing development and use, or is dealt with in road plans.
Road-10. Equipment Refueling and Servicing	Avoid or minimize adverse effects to soil, water quality, and riparian resources from fuels, lubricants, cleaners, and other harmful materials discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources during equipment refueling and servicing activities.	Compliance with Regional BMP 12.22 2-11 and project design features.
Road-11. Road Storm Damage Surveys	Monitor road conditions following storm events to detect road failures; assess damage or potential damage to waterbodies, riparian resources, and watershed functions; determine the causes of the failures; and identify potential remedial actions at the damaged sites and preventative actions at similar sites.	Monitoring would apply during project implementation until final acceptance of work items and contract and water quality waiver termination.
Veg-1. Vegetation Management Planning	Use the applicable vegetation management planning processes to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during mechanical vegetation treatment activities.	ID Team planning process and compliance with Regional BMP 12.12 1-1.

BMP	Objective	Compliance
Veg-2. Erosion Prevention and Control	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by implementing measures to control surface erosion, gully formation, mass slope failure, and resulting sediment movement before, during, and after mechanical vegetation treatments.	ID Team planning process and Regional BMPs 12.12 1-2, 1-3, 1-6, 1-9, 1-10, 1-12, 1-13, 1-14, 1-15, 1-16, 1-17, 1-20, 1-21; and 12.52 5-1, 5-2, 5-4, and 5-6.
Veg-3. Aquatic Management Zones	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources when conducting mechanical vegetation treatment activities in the AMZ.	RCO analysis and Regional BMPs 12.12 1-8, and 1-19; 12-52 5-3, and 5-12
Veg-4. Ground-Based Skidding and Yarding Operations	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during ground-based skidding and yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.	Regional BMPs 12.12 1-9, 1-10, 1-11, 1-13, 1-17, and 1-20.
Veg-5. Cable and Aerial Yarding Operations	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources during cable and aerial yarding operations by minimizing site disturbance and controlling the introduction of sediment, nutrients, and chemical pollutants to waterbodies.	ID Team planning process and evaluation was used to develop design criteria to minimize or mitigate potential adverse effects. Regional BMPs 12.12 and 12.52 FSH 2409.15.
Veg-6. Landings	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from the construction and use of log landings.	Regional BMPs 12.12 1-12 and 1-16
Veg-7. Winter Logging	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from winter logging activities.	Regional BMP 12.12 1-5 and 12.52 5-6
Veg-8. Mechanical Site Treatment	Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by controlling the introduction of sediment, nutrients, chemical, or other pollutants to waterbodies during mechanical site treatment.	National BMPs Veg-2 and Veg-3 and Regional BMPs 12.12 1-19 and 12.52 5-1, 5-2, 5-3, and 5-4.
Water Uses Management Activities	The purpose of this set of BMPs is to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from development and operation of infrastructure to collect, impound, store, transmit, and distribute water for uses on and off National Forest System lands.	N/A. Not a part of this project.

APPENDIX G: General Principles for Snag Retention

(Based upon Sierra Nevada Post-Fire Habitat Recommendations, Point Blue Conservation Science)

- For retention purposes, snags are larger than 15 inches dbh and should be clumped and distributed irregularly across treatment units (SNFPAROD, pg. 52.)
- Generally, retention patches should be located more than 150 feet from other unsalvaged fire-killed trees.
- Snag retention patches will be identified as clumps of the largest, densest trees in the unit or will be anchored on a valuable habitat structure such as a pre-fire snag with cavities or very large fire-killed tree or anchored around pre-fire biological use areas such as nests/roosts and areas with records of high densities of breeding spotted owl and goshawk observations.
- Retention patches will be of varying sizes (generally 0.25 to 5 acres in size) distributed in an uneven mosaic within units (heterogeneity in patch size and distribution is desirable).
- Snags as small as 6 inches dbh are used by a number of avian species for foraging and nesting, and should be considered to have value in retention patches.
- Strive to retain very large trees even if outside of a patch, due to their longevity as snags and value as future wood in the developing forest. Individual snags that remain in areas being replanted will provide the only source of down wood in developing forests for decades to come and will increase the quality of both early-seral and young-forest habitat for wildlife.
- In larger salvage units snag retention patches can be larger and more widely spaced; in smaller or more narrow units smaller patches will be distributed more frequently through the unit.
- Consider GTR 220 principles when identifying size and distribution of snag retention patches by retaining larger, more widely spaced patches on north and east aspects, and more closely spaced patches on south and west aspects.
- Snag retention clumps should remain unplanted to provide a mosaic of complex early-seral forest and future uneven-age forest structure in developing stands.

Vegetation - Appendix H
Treatment Acres by Fire Severity by Vegetation on National Forest Lands for the Project Area and as Treated by Each Alternative

Table H.1 Vegetation Types by Fire Severity for National Forest System Lands in the Analysis Area

Vegetation Type	Basal Area Mortality (acres)				Grand Total
	0-25%	25-75%	75-90%	90%+	
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	18,069	3,380	982	17,295	**39,726**
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	624	289	93	1,073	**2,079**
Early-Seral Conifer and Conifer/Hardwood	2,360	650	212	3,036	**6,258**
Non-Forested Areas	1,115	530	189	2,183	**4,017**
Hardwood	3,889	1,491	425	5,774	**11,579**
Grand Total	**26,057**	**6,340**	**1,901**	**29,362**	**63,659**

Table H.2 Analyzed Area of Effects for Proposed Treatments by Basal Area Mortality for Alternative 2

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Harvest (Salvage or Biomass)	**1,252**	**1,119**	**410**	**8,865**	**11,646**
Mid- to Late-Seral Closed Canopy Conifer and	803	694	249	6,217	7,963
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	206	182	60	800	1,248
Early-Seral Conifer and Conifer/Hardwood	153	149	61	915	1,279
Non-Forested Areas	47	53	26	539	665
Hardwood	43	41	13	394	490
Burn Only	**42**	**61**	**29**	**1,925**	**2,058**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	4	7	3	1,103	1,118
Early-Seral Conifer and Conifer/Hardwood	1	1	1	191	195
Non-Forested Areas	25	21	10	96	152
Hardwood	12	32	14	535	593
Hand Fall and Pile	**122**	**106**	**33**	**594**	**855**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	67	24	7	150	248

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	4	5	2	16	27
Early-Seral Conifer and Conifer/Hardwood	5	13	4	74	96
Non-Forested Areas	15	29	9	130	184
Hardwood	31	36	11	223	301
Hazard Tree Falling for Resource Protection	**81**	**38**	**16**	**215**	**351**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	58	20	7	128	213
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	4	2	11	19
Early-Seral Conifer and Conifer/Hardwood	14	7	2	33	56
Non-Forested Areas	3	5	2	16	27
Hardwood	3	3	2	27	35
Mastication and Hazard Tree Falling	**61**	**57**	**30**	**332**	**480**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	37	29	13	137	217
Early-Seral Conifer and Conifer/Hardwood	19	9	3	43	75
Non-Forested Areas	2	3	2	66	72
Hardwood	4	16	12	86	117
Mastication or Piling	**86**	**105**	**46**	**900**	**1,137**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	24	17	7	138	187
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	9	5	59	76
Early-Seral Conifer and Conifer/Hardwood	53	64	26	538	680
Non-Forested Areas	5	12	6	149	172
Hardwood	2	3	2	16	23
Plant and Release Only		**2**	**2**	**423**	**428**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood		-	-	37	37
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood		-	-	6	6
Early-Seral Conifer and Conifer/Hardwood	-	1	1	252	254
Non-Forested Areas		-	1	128	129

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Hardwood				1	1
Watershed Improvement Treatment Only*	**2**	**6**	**4**	**275**	**287**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	2	5	3	203	213
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	-	-	-	20	20
Early-Seral Conifer and Conifer/Hardwood	-	-	-	16	16
Non-Forested Areas	-	-	-	31	31
Hardwood	-	-	-	5	5
Roadside Hazard Tree Removal Only*	**1,721**	**304**	**91**	**848**	**2,964**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	1,217	166	50	469	1,902
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	69	17	3	19	108
Early-Seral Conifer and Conifer/Hardwood	248	46	13	95	402
Non-Forested Areas	76	28	9	91	205
Hardwood	111	47	16	173	347

***** Areas of proposed Watershed Improvement Treatments and Roadside Hazard occur in additional areas proposed for other treatments with this Alternative.

Table H.3 Roadside Hazard Removal Proposed in Areas that Overlap with Non-Harvest Proposed Treatment in Alternative 2

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Burn Only	**0**	**2**	**1**	**168**	**171**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood		0		99	99
Early-Seral Conifer and Conifer/Hardwood		0		29	29
Non-Forested Areas	0	1	1	19	22
Hardwood				21	21
Hand Fall and Pile	**16**	**14**	**6**	**86**	**122**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	9	3	1	20	33

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	2	1	3	7
Early-Seral Conifer and Conifer/Hardwood	0	1	0	8	10
Non-Forested Areas	2	3	2	18	25
Hardwood	3	4	2	36	46
Hazard Tree Falling for Resource Protection	**18**	**10**	**5**	**41**	**75**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	12	5	2	27	47
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	3	2	3	10
Early-Seral Conifer and Conifer/Hardwood	3	1	0	7	11
Non-Forested Areas	0	0	0	3	4
Hardwood	1	1	0	1	2
Mastication and Hazard Tree Falling	**1**	**6**	**3**	**19**	**30**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	0	4	2	2	8
Early-Seral Conifer and Conifer/Hardwood	1	2	1	10	14
Non-Forested Areas	0	1	1	6	8
Mastication or Piling	**40**	**44**	**16**	**212**	**312**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	15	9	3	32	59
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	1	5	2	10	19
Early-Seral Conifer and Conifer/Hardwood	21	26	8	131	186
Non-Forested Areas	2	4	2	36	44
Hardwood	0	0	0	3	4
Plant and Release Only		**1**	**1**	**116**	**118**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood		0		14	14

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood		0	0	3	4
Early-Seral Conifer and Conifer/Hardwood		0	0	67	68
Non-Forested Areas		0	1	32	33
Hardwood				0	0
Watershed Improvement Treatment Only	**0**	**2**	**2**	**28**	**32**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	0	2	1	25	29
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood			0	2	2

Table H.4 Analyzed Area of Effects for Proposed Treatments by Basal Area Mortality for Alternative 3

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Harvest (Salvage or Biomass)	**795**	**712**	**258**	**7,013**	**8,778**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	500	452	163	5,055	6,169
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	154	126	41	602	923
Early-Seral Conifer and Conifer/Hardwood	91	82	31	627	831
Non-Forested Areas	34	34	17	437	521
Hardwood	17	20	6	292	335
Burn Only	**46**	**66**	**32**	**1,942**	**2,085**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	6	11	6	1,114	1,137
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood				0	0
Early-Seral Conifer and Conifer/Hardwood	1	1	1	191	195
Non-Forested Areas	26	21	10	96	153
Hardwood	13	33	14	540	599

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Hand Fall and Pile	**74**	**49**	**14**	**355**	**492**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	57	14	4	122	198
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	3	1	15	21
Early-Seral Conifer and Conifer/Hardwood	3	7	2	58	70
Non-Forested Areas	9	18	4	68	100
Hardwood	3	7	3	92	104
Hazard Tree Falling for Resource Protection	**59**	**35**	**15**	**186**	**296**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	39	17	6	109	170
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	4	2	10	18
Early-Seral Conifer and Conifer/Hardwood	14	7	2	28	50
Non-Forested Areas	2	5	2	15	24
Hardwood	3	3	2	25	33
Mastication and Hazard Tree Falling	**46**	**56**	**30**	**332**	**464**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	26	29	13	137	205
Early-Seral Conifer and Conifer/Hardwood			0	0	0
Non-Forested Areas	15	9	3	43	69
Hardwood	2	3	2	66	72
Mastication or Piling	4	16	12	86	117
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	**58**	**66**	**28**	**561**	**713**
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	21	14	5	63	103
Early-Seral Conifer and Conifer/Hardwood	2	8	5	50	66
Non-Forested Areas	32	36	13	317	399
Hardwood	2	5	3	121	131
Plant and Release Only	1	2	1	11	15

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	**0**	**2**	**1**	**419**	**422**
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood		0		36	36
Early-Seral Conifer and Conifer/Hardwood		0	0	6	6
Non-Forested Areas	0	1	0	249	250
Hardwood	0	0	1	127	129
Watershed Improvement Treatment Only*				1	1
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	**2**	**6**	**4**	**282**	**294**
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	5	3	203	212
Early-Seral Conifer and Conifer/Hardwood		0	0	16	16
Non-Forested Areas	0	1	1	29	30
Hardwood	0	0	0	28	28
Roadside Hazard Tree Removal Only*	0	0	0	6	7
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	**1,741**	**326**	**101**	**1,044**	**3,211**
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	1,228	176	54	557	2,015
Early-Seral Conifer and Conifer/Hardwood	69	17	4	29	120
Non-Forested Areas	253	53	16	140	462
Hardwood	78	30	10	102	219

***** Areas of proposed Watershed Improvement Treatments and Roadside Hazard also occur in areas proposed for other treatments with this Alternative.

Table H.5 Roadside Hazard Removal Proposed in Areas that Overlap with Non-Harvest Proposed Treatment in Alternative 3

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Burn Only		**2**	**1**	**168**	**171**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood		0		99	99
Early-Seral Conifer and Conifer/Hardwood				29	29
Non-Forested Areas		1	1	19	22
Hardwood				21	21
Hand Fall and Pile	**12**	**10**	**4**	**52**	**78**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	9	1	1	16	26
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	2	1	3	7
Early-Seral Conifer and Conifer/Hardwood	0	1	0	6	8
Non-Forested Areas	1	3	1	17	22
Hardwood	1	2	1	10	14
Hazard Tree Falling for Resource Protection	**13**	**10**	**5**	**41**	**68**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	8	4	2	27	41
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	3	2	3	10
Early-Seral Conifer and Conifer/Hardwood	3	1	0	7	11
Non-Forested Areas		0	0	3	4
Hardwood	1	1	0	1	2
Mastication and Hazard Tree Falling	**1**	**6**	**3**	**19**	**30**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	0	4	2	2	8
Early-Seral Conifer and Conifer/Hardwood	1	2	1	10	14
Non-Forested Areas	0	1	1	6	8
Mastication or Piling	**36**	**39**	**13**	**181**	**268**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	14	8	3	25	51

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	1	5	2	9	18
Early-Seral Conifer and Conifer/Hardwood	19	22	6	114	161
Non-Forested Areas	1	4	2	31	37
Hardwood	0	0	0	1	1
Plant and Release Only		**1**	**1**	**116**	**118**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood		0		14	14
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood		0	0	3	4
Early-Seral Conifer and Conifer/Hardwood		0	0	67	68
Non-Forested Areas		0	1	32	33
Watershed Improvement Treatment Only	**0**	**2**	**2**	**38**	**42**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	0	2	1	34	37
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood			0	2	2
Early-Seral Conifer and Conifer/Hardwood		0	0	1	1

Table H.6 Analyzed Area of Effects for Proposed Treatments by Basal Area Mortality for Alternative 4

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Harvest (Salvage, Roadside Salvage or Biomass)	**3,984**	**1,618**	**565**	**10,619**	**16,786**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	2,675	965	331	7,174	11,145
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	320	206	70	837	1,433
Early-Seral Conifer and Conifer/Hardwood	536	214	76	1,102	1,927
Non-Forested Areas	234	112	44	690	1,080
Hardwood	218	122	44	817	1,201
Burn Only	**42**	**61**	**29**	**1,865**	**1,997**

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	4	7	3	1,075	1,089
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood				0	0
Early-Seral Conifer and Conifer/Hardwood	1	1	1	174	178
Non-Forested Areas	25	21	10	90	146
Hardwood	12	32	14	525	583
Hand Fall and Pile	**229**	**100**	**28**	**484**	**840**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	155	27	7	131	320
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	3	1	11	16
Early-Seral Conifer and Conifer/Hardwood	16	12	4	63	95
Non-Forested Areas	18	26	8	107	159
Hardwood	38	32	8	172	250
Hazard Tree Falling for Resource Protection	**55**	**25**	**9**	**160**	**249**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	39	13	4	90	146
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	0	0	0	8	8
Early-Seral Conifer and Conifer/Hardwood	10	6	2	24	41
Non-Forested Areas	3	4	2	13	22
Hardwood	2	2	2	25	31
Mastication and Hazard Tree Falling	**61**	**57**	**30**	**332**	**480**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	37	29	13	137	216
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood			0	0	0
Early-Seral Conifer and Conifer/Hardwood	19	9	3	43	75
Non-Forested Areas	2	3	2	66	72
Hardwood	4	16	12	86	117
Mastication or Piling	**87**	**108**	**47**	**921**	**1,162**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	26	20	8	155	208

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	2	9	5	59	76
Early-Seral Conifer and Conifer/Hardwood	53	65	26	542	686
Non-Forested Areas	5	12	6	149	172
Hardwood	1	2	1	15	20
Plant and Release Only	**0**	**2**	**2**	**405**	
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood		0	0	37	37
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood		0	0	6	6
Early-Seral Conifer and Conifer/Hardwood	0	1	1	237	239
Non-Forested Areas	0	0	1	125	127
Watershed Improvement Treatment Only*	**66**	**69**	**36**	**481**	**652**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	38	32	15	152	237
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	0	2	2	405	410
Early-Seral Conifer and Conifer/Hardwood	19	9	4	80	112
Non-Forested Areas	2	3	2	72	78
Hardwood	4	17	12	323	356
Roadside Hazard Tree Removal Only*	**71**	**27**	**8**	**180**	**287**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	35	11	4	111	160
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	11	2	0	8	21
Early-Seral Conifer and Conifer/Hardwood	16	7	3	19	46
Non-Forested Areas	9	7	2	16	33
Hardwood	1	0	0	26	27

***** Areas of proposed Watershed Improvement Treatments and Roadside Hazard also occur in areas proposed for other treatments with this Alternative.

Table H.7 Roadside Hazard Removal Proposed in Areas that Overlap with Non-Harvest Proposed Treatment in Alternative 4

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Burn Only				**31**	**31**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood				17	17
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood				0	0
Early-Seral Conifer and Conifer/Hardwood				5	5
Non-Forested Areas				2	2
Hardwood				7	7
Hand Fall and Pile				**6**	**6**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood				4	4
Non-Forested Areas				1	1
Hardwood				2	2
Hazard Tree Falling for Resource Protection				**1**	**1**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood				1	1
Mastication or Piling	**2**	**6**	**2**	**56**	**67**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood	0	1	1	9	10
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood	0	0	0	1	1
Early-Seral Conifer and Conifer/Hardwood	2	5	2	38	48
Non-Forested Areas		0	0	8	8
Plant and Release Only		**0**	**0**	**35**	**35**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood				6	6
Mid- to Late-Seral Open Canopy Conifer and Conifer/Hardwood				1	1

Treatment Type and Vegetation Type	Basal Area Mortality				Grand Total
	0-25%	25-75%	75-90%	90%+	
Early-Seral Conifer and Conifer/Hardwood			0	20	20
Non-Forested Areas		0	0	8	8
Watershed Improvement Treatment Only				**1**	**1**
Mid- to Late-Seral Closed Canopy Conifer and Conifer/Hardwood				1	1

Treatment by Fire Severity and Vegetation Type for Each Alternative

Table H.8 Probable Changes in CWHR Resulting from the King Fire

CWHR Vegetation Type	Percent Basal Area Mortality	Post-Fire Typing Convention
MHC, JPN, PPN, RFR, SMC, WFR,	0	No change in CWHR Veg Type, Size, or Density Classes
	0-10	No change in CWHR Veg Type, Size, or Density Classes
	10-25	No change in CWHR Veg Type, Size, or Density Classes in most cases
	25-50	No change in CWHR Veg Type or Size, but CWHR Density D/M →P, P→S
	50-75	No change in CWHR Veg Type or Size Class, but CWHR Density D/M/P →S
	75-90	Change Veg Type to MCP or, in the case of MCH, potentially to MHW, CWHR Size → 1 and Density to "null"
	90-100	Change Veg Type to MCP or, in the case of MCH, potentially to MHW, CWHR Size → 1 and Density to "null"
AGS, BAR, CRC, LAC, MCP, PGS, RIV, URB, WTM	0-100	No Change in Veg Type or Size Class density (because these types often don't have size class or density associated with them)
BOP, BOW, CPC, MHW, MRI	0-25	No Change in CWHR Veg Type, Size, or Density Classes
	25-50	No change in Veg Type or Size, but CWHR Density D/M →P, P stays P and S stays S
	50-75	No change in CWHR Veg Type or Size Class, but CWHR Density D →P and M/P→S
	75-100	No change in CWHR Veg Type, but change Size and Density Classes to 1 and "null" respectively

AGS = Annual Grass
BAR = Barren
BOP = Blue Oak-Foothill Pine
BOW = Blue Oak Woodland
CPC = Closed Cone Pine
CRC = Chamise-Redshank Chaparral
JPN = Jeffrey Pine
LAC = Lacustrine
MHC = Montane Hardwood-Conifer
MCP = Montane Chaparral
MHW = Montane Hardwood
MRI = Montane Riparian
PGS = Perennial Grassland
PPN = Ponderosa Pine
RIV = Riverine
SMC = Sierran Mixed Conifer
RFR = Red Fir
URB = Urban
WFR = White Fir
WTM = Wet Meadow

Watersheds – Appendix I

King Fire Restoration Project

Eldorado National Forest – Georgetown and Pacific Ranger Districts

Riparian Conservation Objectives Consistency Report

April 8, 2015

This report evaluates the King Fire Restoration Project with respect to the Riparian Conservation Objectives (RCOs) and associated Standards and Guidelines (S&Gs) of the Sierra Nevada Forest Plan Amendment (SNFPA) of 2004, which amends the Eldorado National Forest Plan of 1988.

Implementation of this project is expected to meet all of the RCOs and associated S&Gs.

/s/

Vince Pacific, Hydrologist

/s/

Maura Santora, Aquatic Biologist

/s/

Blake Engelhardt, Botanist

/s/

Eric Nicita, Soil Scientist

The Sierra Nevada Forest Plan Amendment Record of Decision (SNFPAROD) of 2004 requires that a site-specific analysis be conducted in order to determine the type and extent of activities that can occur within Riparian Conservation Areas (RCAs) adjacent to aquatic features. Descriptions of RCAs as designated by SNFPROD (2004) are presented in Table 1.

Table 1. Riparian Conservation Areas (RCAs) Adjacent to Aquatic Features as Designated by the Sierra Nevada Forest Plan Amendment Record of Decision (SNFPROD) of 2004.[1]

Aquatic feature	Riparian Conservation Area
Perennial stream	300 feet on each side of the stream, measured from the bank full edge of the stream
Seasonally flowing streams (includes intermittent and ephemeral streams)	150 feet on each side of the stream, measured from the bank full edge of the stream
Special aquatic features (includes lakes, wet meadows, bogs, fens, wetlands, vernal pools, and springs)	300 feet from the edge of the features or riparian vegetation, whichever width is greater
Perennial streams with riparian conditions extending more than 150 feet from the edge of the streambank or seasonally flow streams extending more than 50 feet from the edge of the streambank	300 feet from the edge of the features or riparian vegetation, whichever width is greater
Streams in inner gorge	Top of inner gorge. (The inner gorge is defined by stream adjacent slopes greater than 70% gradient.)
Other hydrological or topographic depressions without a defined channel	RCA width and protection measures determined through project level analysis

[1] Riparian Conservation Areas (RCAs) are designated on page 42 of the SNFPAROD (2004); RCOs are described on pages 33 and 34.

Many RCAs burned at high intensity during the King Fire, which resulted in removal of groundcover and riparian vegetation, and increased erosion and sediment transport to streams. Treatment activities are proposed within RCAs that burned at moderate and high intensity to reduce future fuel loading and promote improvements to habitat and water quality. “Treatment zones” have been designated within RCAs, which have specific operating guidelines (Table 2.13 of the EIS). These include mechanical exclusion zones that generally range from 50-100 feet or greater on perennial and intermittent streams (or 25 feet beyond the edge of riparian vegetation, whichever is greater), and 10-25 feet or greater on ephemeral streams. At a limited number of locations (referred to as Watershed Sensitive Areas in the EIS), some ground disturbance is proposed within mechanical exclusion zones where additional work is necessary to promote recovery or fall hazard trees within these areas. Varied levels of ground disturbance would be permitted in middle and outer treatment zones. BMPs, mitigation measures, and project design criteria would minimize potential for impacts. Implementation of the proposed action would likely result in short-term impacts to riparian and aquatic habitat from logging-related compaction and erosion, but long-term improvements to RCAs and associated aquatic features and habitat by increasing groundcover and reducing erosion and sediment transport to streams and other aquatic features. Treatment activities would also reduce or eliminate erosion from past ground disturbances within and adjacent to RCAs, the severity of which has increased as a result of the fire.

The SNFPROD (2004) contains six RCOs that apply to activities within RCAs.

Riparian Conservation Objective #1: *Ensure that identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses.*

The California Regional Water Quality Control Board, Central Valley Region, has established beneficial uses for surface water bodies in the *Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins* (2007). The project area is within both the Middle Fork of the American River Watershed and the South Fork of the American River Watershed. Currently, the Middle Fork American River from its source to Folsom Lake, California, has been designated by the State for: municipal and domestic supply, irrigation, stock watering, power, contact and other non-contact recreation, canoeing and rafting, warm and cold freshwater fisheries habitat migration and spawning, and wildlife habitat. The South Fork American River, from its source to Placerville, has been designated by the State for: municipal and domestic water supply, power, contact and other non-contact recreation, canoeing and rafting, warm and cold freshwater fisheries habitat migration and spawning, and wildlife habitat. The Stumpy Meadows Reservoir, which is adjacent to the project site, is the sole drinking water supply for the town of Georgetown and surrounding areas.

The California Regional Water Quality Control Board, Central Valley Region, has established water quality objectives for inland surface waters in the Sacramento and San Joaquin River Basins (Appendix A). Parameters of particular concern with respect to the proposed action would be sediment, settleable materials, suspended materials, and turbidity. These parameters have the potential to adversely impact water quality and aquatic habitat which could in turn affect beneficial uses of water. BMPs and project design criteria would be applied to ensure adequate protection of the beneficial uses of water within the project area. These would include near-stream riparian mechanical exclusion zones and post-implementation groundcover requirements.

The *Section 303(d) List of Water Quality Limited Segments* (2006) was created by the Central Valley Regional Board to comply with Section 303(d) of the Clean Water Act of 1972 which requires each state to identify water bodies that fail to meet applicable water quality standards established by the US EPA. The South Fork American River, from below Slab Creek Reservoir to Folsom Lake, is on the State 303(d) List with respect to elevated levels of mercury due to resource extraction (mining). This project would not impact mercury concentrations in the South Fork American River. No other 303(d) streams are located within or downstream of the project area.

Each RCO contains applicable standards and guidelines. See Appendix B for analysis of each standard and guideline with respect to the proposed actions. The implementation of these standards and guidelines, along with applicable BMPs, would protect the beneficial uses of water.

Riparian Conservation Objective #2: *Maintain or restore: 1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; 2) streams, including instream flows; and 3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species.*

The primary threat to these aquatic features is the increased watershed response in uplands burned by the fire. Post-fire BAER treatments included mulching to reduce soil erosion and maintenance and improvements to road drainage structures to reduce the potential for road washouts. Project activities may have some short-term impacts to the geomorphic and biological characteristics of streams and other aquatic features within the project area. For example, there is potential for compaction, erosion, and sediment delivery to aquatic features with use of heavy machinery in RCAs which could decrease the quality of cold water fish habitat by infilling pools and embedding spawning gravels. Alternatively, land disturbance could cause concentration of surface runoff, which could result in detrimental changes to stream channel condition that could subsequently have effects on downstream water quality and beneficial uses. However, BMPs, project design criteria, and applicable standards and guidelines would minimize impacts. Further, the areas where work is proposed within RCAs burned at high intensity, and all groundcover and riparian vegetation was fully consumed at most locations. Salvage logging would result in increased groundcover that would reduce sediment transport to streams and aid in riparian zone recovery following the fire.

The project also proposes small-scale stream and RCA restoration, such as treating gullies and stabilizing streambanks at a limited number of locations. Larger-scale restoration of impaired aquatic features is outside the scope of this project; however, identified restoration needs may be addressed in future projects.

Riparian Conservation Objective #3: *Ensure a renewable supply of large down logs that: 1) can reach the stream channel, and 2) provide suitable habitat within and adjacent to the RCA.*

Mechanical exclusion zones within RCAs (Table 2.13 of the EIS) would ensure a renewable supply of large down logs within and adjacent to stream channels due to the large number of snags within these areas. In the areas outside of mechanical exclusion zones, but still within RCAs, requirements for standing snags and large down logs would ensure a long-term supply of large wood to provide suitable habitat. Reforestation, following requirements set forth in project design criteria, in areas that are salvage logged would also contribute to long-term large wood recruitment.

Riparian Conservation Objective #4: *Ensure that management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species.*

No CARs are present within the project area. The Proposed Action would result in short-term impacts but long-term improvements to RCAs. Use of heavy machinery in and adjacent to RCAs may lead to ground disturbance and increased potential for sediment transport to streams. However, BMPs and project design criteria would limit the potential for these short-term impacts. While short-term impacts may occur, the project would lead to long-term improvements and enhance both the physical and biological characteristics associated with aquatic- and riparian-dependent species. For example, groundcover was fully consumed in many of the logging units, and implementation of this project would increase groundcover which would reduce future erosion.

Riparian Conservation Objective #5: *Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fens, and wetlands to provide the ecological conditions and processes needed to recover or enhance the viability of species that rely on these areas.*

In general, mechanical exclusion would prevent disturbance to aquatic features. Treatments in middle and outer RCA zones may result in short-term impacts such as soil compaction and erosion. However, BMPs and project design criteria would minimize potential for these short-term impacts. The areas in which treatments are proposed burned at high intensity and little to no groundcover or riparian vegetation is present. Implementation of project design criteria would result in increased groundcover, and planting trees and native riparian vegetation in areas that are logged is proposed would enhance habitat over the long-term in areas of moderate and high burn severity.

Riparian Conservation Objective #6: *Identify and implement restoration actions to maintain, restore, or enhance water quality and maintain, restore, or enhance habitat for riparian and aquatic species.*

Project activities would increase groundcover and provide habitat within RCAs due to snag and large down wood design criteria. Treatments would also include obliteration of existing disturbances such as old skid trails and landings that are current sources of erosion. The project also proposes small-scale stream and RCA restoration projects, such as stabilizing streambanks and gullies at a limited number of locations. Implementation of these projects would restore or enhance water quality and habitat for riparian and aquatic species. Larger-scale restoration of impaired aquatic features is outside the scope of this project; however, identified restoration needs may be addressed in future projects.

References Cited

Central Valley Regional Water Quality Control Board. 2008. Internet Site containing the proposed 303(d) list for the central valley region of California http://www.waterboards.ca.gov/tmdl/docs/303dlists2006/final/r5_final303dlist.pdf

Central Valley Regional Water Quality Control Board. 2009. Internet containing Basin Plan for the Central Valley Region. http:/www.swrcb.ca.gov/centralvalley/water_issues/basin_plans

USDA Forest Service. January 2004. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement, Record of Decision.

WATER QUALITY OBJECTIVES FOR INLAND SURFACE WATERS

Category	Standard
Bacteria	In waters designated for contact recreation, the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than ten percent of the total number of samples taken during any 30-day period exceed 400/100 ml.
Chemical Constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses.
Color	Water shall be free of discoloration that causes nuisance or adversely affects beneficial uses.
Dissolved Oxygen	Dissolved oxygen concentrations shall not be reduced below the following minimum levels at any time: ▪ Waters designated WARM 5.0 mg/l ▪ Waters designated COLD 7.0 mg/l ▪ Waters designated SPWN 7.0 mg/l
Floating Material	Water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other material in concentrations that cause nuisance, result in visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
pH	The pH shall not be depressed below 6.5 nor raised above 8.5.
Pesticides	▪ No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. ▪ Discharges shall not result in pesticide concentrations in bottom sediments or aquatic life that adversely affect beneficial uses. ▪ Total identifiable persistent chlorinated hydrocarbon pesticides shall not be present in the water column at concentrations detectable within the accuracy of analytical methods approved by the EPA or the Executive Officer. ▪ Pesticide concentrations shall not exceed those allowable by applicable antidegradation policies (see State Water Resources Control Board Resolution No. 68-16 and 40 C.F.R. Section 131.12.). ▪ Pesticide concentrations shall not exceed the lowest levels technically and economically achievable. ▪ Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the Maximum Contaminant Levels set forth in California Code of Regulations, Title 22, Division 4, Chapter 15. ▪ Waters designated for use as domestic or municipal supply shall not contain concentrations of thiobencarb in excess of 1.0 µg/l.
Total Dissolved Solids	Shall not exceed 100 mg/l (90 percentile)
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Category	Standard
Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Tastes and Odors	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.
Temperature	At no time or place shall the temperature of COLD or WARM interstate waters be increased more than 5˚F above natural receiving water temperature.
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: ▪ Where natural turbidity is less than 1 Nephelometric Turbidity Unit (NTU), controllable factors shall not cause downstream turbidity to exceed 2. ▪ Where natural turbidity is between 1 and 5 NTUs, increases shall not exceed 1 NTU. ▪ Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent. ▪ Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs. ▪ Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

California Regional Water Quality Control Board, Central Valley Region, Basin Plan (2007).

APPENDIX B. RIPARIAN CONSERVATION (RCAs & RCOs) STANDARDS and GUIDELINES

Riparian Conservation Areas and Critical Aquatic Refuges	
Standard and Guideline	**Analysis with respect to Proposed Action**
91. Designate riparian conservation area (RCA) widths as described in Table 6 above. The RCA widths displayed in Table 2 may be adjusted at the project level if a landscape analysis has been completed and a site-specific RCO analysis demonstrates a need for different widths.	RCA widths are shown in Table 2.13 of the EIS, which includes mechanical exclusion zones and middle and outer zones with specific operating requirements and restrictions. The widths were chosen as they would provide for improvement to riparian zone conditions while at the same time providing adequate protection for RCAs and dependent species.
92. Evaluate new proposed management activities within CARs and RCAs during environmental analysis to determine consistency with the riparian conservation objectives at the project level and the AMS goals for the landscape. Ensure that appropriate mitigation measures are enacted to (1) minimize the risk of activity-related sediment entering aquatic systems and (2) minimize impacts to habitat for aquatic- or riparian-dependent plant and animal species.	There are no CARs within the project area. The proposed activities within RCAs would be consistent with RCOs, and implementation of this project would maintain or improve aquatic habitat and channel complexity from its current post-fire condition. The proposed activities would be implemented with applicable BMPs and project design criteria, and by following RCA and RCO standards and guidelines to minimize potential for activity-related sediment from entering streams and negatively impacting aquatic and riparian-dependent plant and animal species.
93. Identify existing uses and activities in CARs and RCAs during landscape analysis. At the time of permit reissuance, evaluate and consider actions needed for consistency with RCOs.	Existing uses and activities were identified as part of project analysis. Implementation of BMPs and project design criteria would ensure consistency with RCOs.
94. As part of project-level analysis, conduct peer reviews for projects that propose ground-disturbing activities in more than 25 percent of the RCA or more than 15 percent of a CAR.	There are no CARs within the project area, and the footprint of ground disturbing activities in RCAs would not exceed the 25% threshold. Therefore, peer reviews are not necessary.
Riparian Conservation Objective #1: Ensure that identified beneficial uses for the water body are adequately protected. Identify the specific beneficial uses for the project area, water quality goals from the Regional Basin Plan, and the manner in which the standards and guidelines will protect the beneficial uses. (AMS goals: 1, 2, 7)	
95. For waters designated as “Water Quality Limited” (Clean Water Act Section 303(d)), participate in the development of Total Maximum Daily Loads (TMDLs) and TMDL Implementation Plans. Execute applicable elements of completed TMDL Implementation Plans.	The South Fork American River, from below Slab Creek Reservoir to Folsom Lake, is on the 303(d) list of impaired waters with respect to elevated levels of mercury due to resource extraction (mining). This project would not impact mercury levels in the South Fork American River and the TMDL monitoring plan would not be applicable to this project.

Standard and Guideline	Analysis with respect to Proposed Action
96. Ensure that management activities do not adversely affect water temperatures necessary for local aquatic- and riparian-dependent species assemblages.	The proposed activities would have negligible short term effects on water temperature. With the exception of hazard trees, no trees would be felled within streamside mechanical exclusion zones. Salvage logging within RCAs outside of the mechanical exclusion zone would only occur in areas of moderate to high burn intensity where the majority of trees had all needles consumed and thus provide little to no shade. Natural regeneration of riparian vegetation is already occurring and will provide stream shade as it becomes reestablished.
97. Limit pesticide applications to cases where project level analysis indicates that pesticide applications are consistent with riparian conservation objectives.	No new pesticide use within RCAs is proposed for this project. Limited pesticide use for targeted invasive species treatment would continue under the previous project decision Forestwide Treatment of Invasive Species Project (ENF 2013), which includes project design criteria to protect RCAs and associated plant and animal species.
98. Within 500 feet of known occupied sites for the California red-legged frog, Cascades frog, Yosemite toad, foothill yellow-legged frog, mountain yellow-legged frog, and northern leopard frog, design pesticide applications to avoid adverse effects to individuals and their habitats.	Pesticides would not be used within 500 feet of known occupied sites for California red-legged frog or within 300 feet of suitable habitat for mountain yellow-legged frog. Herbicide application for targeted invasive plant treatment within 500 feet will be reviewed and approved annually by the FS aquatic biologist, and design criteria will be implemented to ensure there is no adverse effect to individuals or their habitats.
99. Prohibit storage of fuels and other toxic materials within RCAs and CARs except at designated administrative sites and sites covered by a Special Use Authorization. Prohibit refueling within RCAs and CARs unless there are no other alternatives. Ensure that spill plans are reviewed and up-to-date.	Following BMPs and project design criteria, the storage of fuels and other toxic materials, servicing, and refueling would not occur within RCAs. BMPs and spill prevention measures to avoid adverse impacts to nearby water bodies would be implemented. Up-to-date spill plans would be required and reviewed prior to project implementation.
Riparian Conservation Objective #2: Maintain or restore: (1) the geomorphic and biological characteristics of special aquatic features, including lakes, meadows, bogs, fens, wetlands, vernal pools, springs; (2) streams, including in stream flows; and (3) hydrologic connectivity both within and between watersheds to provide for the habitat needs of aquatic-dependent species. (AMS goals: 2, 3, 4, 5, 6, 8, 9)	
100. Maintain and restore the hydrologic connectivity of streams, meadows, wetlands, and other special aquatic features by identifying roads and trails that intercept, divert, or disrupt natural surface and subsurface water flow paths. Implement corrective actions where necessary to restore connectivity.	Roads and trails that are disrupting natural surface and subsurface pathways and transporting sediment towards stream channels have been identified during field reconnaissance and through examination of LiDAR data. Treatment of these disturbances would enhance watershed hydrologic function and connectivity. Treatments may include subsoiling, waterbarring, removal of inslope berms, outsloping, backblading, and/or slash placement.

Standard and Guideline	Analysis with respect to Proposed Action
102. Prior to activities that could adversely affect streams, determine if relevant stream characteristics are within the range of natural variability. If characteristics are outside the range of natural variability, implement mitigation measures and short-term restoration actions needed to prevent further declines or cause an upward trend in conditions. Evaluate required long-term restoration actions and implement them according to their status among other restoration needs.	As a result of the fire, some sections of streams have characteristics that are not within the natural range of variability. For example, in areas where the riparian zone burned at high intensity, large wood within and adjacent to the stream channel was often consumed, and these sections of the streams are now deficient in large wood concentrations. Due to the large concentration of snags within RCAs that burned at high intensity, large wood concentrations within streams and throughout the RCA are expected to recover to within the natural range of variability. Further, in the areas of the RCAs outside of the mechanical exclusion zones where salvage logging is permitted, project design criteria require that minimum numbers of both standing and down large wood is retained to provide for long term recruitment.
103. Prevent disturbance to streambanks and natural lake and pond shorelines caused by resource activities (for example, livestock, off-highway vehicles, and dispersed recreation) from exceeding 20 percent of stream reach or 20 percent of natural lake and pond shorelines. Disturbance includes bank sloughing, chiseling, trampling, and other means of exposing bare soil or cutting plant roots. This standard does not apply to developed recreation sites, sites authorized under Special Use Permits and designated off-highway vehicle routes.	Mechanical exclusion zones in RCAs (Table 2.13 of the EIS) would prevent disturbance to streambanks as a result of project activities. Project design criteria limit the number of stream crossings and include specific measures to reduce potential impacts to streambanks. Disturbance to streambanks would not exceed 20 percent of a stream reach. Natural lake and pond shorelines would not be impacted by this project.
104. In stream reaches occupied by, or identified as "essential habitat" in the conservation assessment for, the Lahontan and Paiute cutthroat trout and the Little Kern golden trout, limit streambank disturbance from livestock to 10 percent of the occupied or "essential habitat" stream reach. (Conservation assessments are described in the record of decision.) Cooperate with State and Federal agencies to develop streambank disturbance standards for threatened, endangered, and sensitive species. Use the regional streambank assessment protocol. Implement corrective action where disturbance limits have been exceeded.	Not applicable to this project.

Standard and Guideline	Analysis with respect to Proposed Action
105. At either the landscape or project-scale, determine if the age class, structural diversity, composition, and cover of riparian vegetation are within the range of natural variability for the vegetative community. If conditions are outside the range of natural variability, consider implementing mitigation and/or restoration actions that will result in an upward trend. Actions could include restoration of aspen or other riparian vegetation where conifer encroachment is identified as a problem.	Riparian vegetation cover is currently outside of the natural range of variability in RCAs that burned at high intensity as most if not all vegetation was consumed by fire in these areas. Project design criteria and BMPs, in particular near-stream and riparian vegetation exclusion zones, are designed to reduce impacts to recovering riparian vegetation. Riparian vegetation is expected to recover quickly, and resprouting willows, maples, and sedges have already been observed in many areas.
106. Cooperate with Federal, Tribal, State and local governments to secure in stream flows needed to maintain, recover, and restore riparian resources, channel conditions, and aquatic habitat. Maintain in stream flows to protect aquatic systems to which species are uniquely adapted. Minimize the effects of stream diversions or other flow modifications from hydroelectric projects on threatened, endangered, and sensitive species.	Water rights are held by the Forest Service and water use would adhere to those limits specified in the water rights. Project design criteria and BMPs require that water drafting sites be approved by a hydrologist and aquatic biologist prior to use and specify flow thresholds in which water drafting must cease. With implementation of design criteria, water drafting would not adversely impact stream flows or lead to pool depletion. The project does not propose flow modifications from hydroelectric projects.
107. For exempt hydroelectric facilities on national forest lands, ensure that special use permit language provides adequate in stream flow requirements to maintain, restore, or recover favorable ecological conditions for local riparian- and aquatic-dependent species.	Not applicable to this project.
Riparian Conservation Objective #3: Ensure a renewable supply of large down logs that: (1) can reach the stream channel and (2) provide suitable habitat within and adjacent to the RCA. (AMS goals: 2, 3)	
108. Determine if the level of coarse large woody debris (CWD) is within the range of natural variability in terms of frequency and distribution and is sufficient to sustain stream channel physical complexity and stability. Ensure proposed management activities move conditions toward the range of natural variability.	In RCAs that burned at high intensity, CWD within and adjacent to some sections of stream channels was fully consumed, and therefore these areas are deficient in CWD. This project is designed to retain an adequate recruitment source for CWD due to near-stream mechanical exclusion zones and snag and CWD requirements. CWD within stream channels would also remain in place. At those channels in which visual reconnaissance occurred, CWD levels were found to be within the range of natural variability both upstream and downstream of sections that burned at high intensity.
Riparian Conservation Objective #4: Ensure that management activities, including fuels reduction actions, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic- and riparian-dependent species. (AMS goals: 2, 7)	

Standard and Guideline	Analysis with respect to Proposed Action
109. Within CARs, in occupied habitat or “essential habitat” as identified in conservation assessments for threatened, endangered, or sensitive species, evaluate the appropriate role, timing, and extent of prescribed fire. Avoid direct lighting within riparian vegetation; prescribed fires may back into riparian vegetation areas. Develop mitigation measures to avoid impacts to these species whenever ground-disturbing equipment is used.	Pile burning would be permitted in treatment units when necessary to reduce ground fuel accumulation. Project design criteria stipulate that burn piles would not be located within 100’ of suitable CRLF or SNYLF habitat. Design criteria also require that piles would only be ignited on the side furthest from the nearest aquatic feature when within 1 mile of suitable CRLF or SNYLF habitat, or within 100 feet of streams and waterbodies. These requirements would also protect riparian vegetation.
110. Use screening devices for water drafting pumps. (Fire suppression activities are exempt during initial attack.) Use pumps with low entry velocity to minimize removal of aquatic species, including juvenile fish, amphibian egg masses and tadpoles, from aquatic habitats.	Specifications for pump intake screens and minimum flow requirements for drafting would minimize impacts to, and removal of, aquatic species. Low velocity pumps would also be required.
111. Design prescribed fire treatments to minimize disturbance of groundcover and riparian vegetation in RCAs. In burn plans for project areas that include, or are adjacent to RCAs, identify mitigation measures to minimize the spread of fire into riparian vegetation. In determining which mitigation measures to adopt, weigh the potential harm of mitigation measures, for example fire lines, against the risks and benefits of prescribed fire entering riparian vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could be damaging to habitat or long-term function of the riparian community.	Project design criteria stipulate that burn piles would not be located within 100’ of suitable CRLF or SNYLF habitat. Design criteria also require that piles would only be ignited on the side furthest from the nearest aquatic feature when within 1 mile of suitable CRLF or SNYLF habitat, or within 100 feet of streams and waterbodies. Project design criteria also stipulate that direct lighting of prescribed fires would not occur in riparian areas and would identify mitigation measures to minimize spread of fire into riparian vegetation. Due to project design criteria impacts to riparian vegetation and riparian- and aquatic-dependent species are not anticipated.
112. Post-wildfire management activities in RCAs and CARs should emphasize enhancing native vegetation cover, stabilizing channels by non-structural means, minimizing adverse effects from the existing road network, and carrying out activities identified in landscape analyses. Post-wildfire operations shall minimize the exposure of bare soil.	This project is designed to promote an upward trend in RCA conditions. Tree removal is proposed within RCAs (but outside of mechanical exclusion zones) where fire burned at moderate to high intensities. In these areas, most, if not all, groundcover and CWD was consumed, and barren ground, erosion, and sediment transport to streams has occurred at many locations. Project design criteria require 70% groundcover and various levels of CWD within RCAs, which would reduce erosion. This level of groundcover is not expected to negatively impact reestablishment of native vegetation, and planting of native riparian vegetation is proposed where recovery is limited. When sensitive plant species are present (see Botanical Resource Design Criteria), depth of slash material is limited to 2 inches so as not to impact reestablishment of these species.

Standard and Guideline	Analysis with respect to Proposed Action
113. Allow hazard tree removal within RCAs or CARs. Allow mechanical ground disturbing fuels treatments, salvage harvest, or commercial fuelwood cutting within RCAs or CARs when the activity is consistent with RCOs. Utilize low ground pressure equipment, helicopters, over the snow logging, or other non-ground disturbing actions to operate off of existing roads when needed to achieve RCOs. Ensure that existing roads, landings, and skid trails meet Best Management Practices. Minimize the construction of new skid trails or roads for access into RCAs for fuel treatments, salvage harvest, commercial fuelwood cutting, or hazard tree removal.	Hazard tree removal is proposed within RCAs, including within the mechanical exclusion zone when necessary. Operating requirements for ground based mechanical equipment generally prevent removal of hazard trees (but allow for felling) within near-stream exclusion zones to prevent ground disturbances, the exception being if logs can be removed with full suspension. Tree removal and other fuel treatments consistent with RCOs would be permitted in RCAs outside of the mechanical exclusion zone. Low ground pressure equipment would be required within RCAs to minimize negative impacts from logging operations, and groundcover and CWD requirement would improve RCA function and habitat that have been degraded as a result of the fire. Existing roads, landings, and skid trails would be required to meet BMPs, and all skid trails, temporary roads, and landings would be decommissioned after use. Construction of new skid trails in RCAs (outside of exclusion zones) would be limited to allow for achievement of RCOs.
114. As appropriate, assess and document aquatic conditions following the Regional Stream Condition Inventory protocol prior to implementing ground disturbing activities within suitable habitat for California red-legged frog, Cascades frog, Yosemite toad, foothill and mountain yellow-legged frogs, and northern leopard frog.	Project design criteria require that a qualified aquatic biologist would perform a survey 24 hours before project implementation to assess and document aquatic conditions. The survey would follow the methodology set forth by the USFWS.
15. During fire suppression activities, consider impacts to aquatic- and riparian-dependent resources. Where possible, locate incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities outside of RCAs or CARs. During pre-suppression planning, determine guidelines for suppression activities, including avoidance of potential adverse effects to aquatic- and riparian-dependent species as a goal.	Fire suppression in response to prescribed burning is not anticipated due to requirements set forth in the burn plan. However, if suppression is necessary, or if a wildfire were to occur within the project area, incident activities would not be located within RCAs, and pre-suppression planning would occur to avoid potential adverse effects to aquatic- and riparian-dependent species.
116. Identify roads, trails, OHV trails and staging areas, developed recreation sites, dispersed campgrounds, special use permits, grazing permits, and day use sites during landscape analysis. Identify conditions that degrade water quality or habitat for aquatic and riparian-dependent species. At the project level, evaluate and consider actions to ensure consistency with standards and guidelines or desired conditions.	Roads, trails, etc. were identified during project analysis. Based upon field reconnaissance and analysis of LiDAR data, areas that have, or have potential to, degrade water quality and/or habitat were identified. These include previous logging disturbances such as roads, skid trails, and landings. Implementation of the proposed treatments in these areas would follow project design criteria and BMPs, and the treatments would reduce or eliminate negative impacts to water quality and/or habitat from these disturbances. The proposed actions would ensure consistency with applicable standards and guidelines and desired conditions.

Riparian Conservation Objective #5: Preserve, restore, or enhance special aquatic features, such as meadows, lakes, ponds, bogs, fens, and wetlands, to provide the ecological conditions and processes needed to recover or enhance the viability of species that rely on these areas. (AMS goals 1, 2, 3, 4, 7, 9)	
Standard and Guideline	**Analysis with respect to Proposed Action**
117. Assess the hydrologic function of meadow habitats and other special aquatic features during range management analysis. Ensure that characteristics of special features are, at a minimum, at Proper Functioning Condition, as defined in the appropriate Technical Reports (or their successor publications): (1) “Process for Assessing PFC” TR 1737-9 (1993), “PFC for Lotic Areas” USDI TR 1737-15 (1998) or (2) “PFC for Lentic Riparian-Wetland Areas” USDI TR 1737-11 (1994).	Range management analysis is not applicable to this project.
118. Prohibit or mitigate ground-disturbing activities that adversely affect hydrologic processes that maintain water flow, water quality, or water temperature critical to sustaining bog and fen ecosystems and plant species that depend on these ecosystems. During project analysis, survey, map, and develop measures to protect bogs and fens from such activities as trampling by livestock, pack stock, humans, and wheeled vehicles. Criteria for defining bogs and fens include, but are not limited to, presence of: (1) sphagnum moss (*Spagnum spp*.), (2) mosses belonging to the genus *Meessia*, and (3) sundew (*Drosera spp*.) Complete initial plant inventories of bogs and fens within active grazing allotments prior to re-issuing permits.	There are no bogs or fens known within the areas proposed for treatment. Botanical surveys will be conducted prior to project implementation and if any fens or bogs are detected within proposed treatment units they will be protected by design criteria and mechanical exclusion zones.
19. Locate new facilities for gathering livestock and pack stock outside of meadows and riparian conservation areas. During project-level planning, evaluate and consider relocating existing livestock facilities outside of meadows and riparian areas. Prior to re-issuing grazing permits, assess the compatibility of livestock management facilities located in riparian conservation areas with riparian conservation objectives.	Range management analysis is not applicable to this project.

Standard and Guideline	Analysis with respect to Proposed Action
120. Under season-long grazing: • For meadows in early-seral status: limit livestock utilization of grass and grass-like plants to 30 percent (or minimum 6-inch stubble height). • For meadows in late seral status: limit livestock utilization of grass and grass-like plants to a maximum of 40 percent (or minimum 4-inch stubble height). Determine ecological status on all key areas monitored for grazing utilization prior to establishing utilization levels. Use Regional ecological scorecards and range plant list in regional range handbooks to determine ecological status. Analyze meadow ecological status every 3 to 5 years. If meadow ecological status is determined to be moving in a downward trend, modify or suspend grazing. Include ecological status data in a spatially explicit Geographical Information System database. Under intensive grazing systems (such as rest-rotation and deferred rotation) where meadows are receiving a period of rest, utilization levels can be higher than the levels described above if the meadow is maintained in late seral status and meadow-associated species are not being impacted. Degraded meadows (such as those in early-seral status with greater than 10 percent of the meadow area in bare soil and active erosion) require total rest from grazing until they have recovered and have moved to mid- or late seral status.	Range management analysis is not applicable to this project.
121. Limit browsing to no more than 20 percent of the annual leader growth of mature riparian shrubs and no more than 20 percent of individual seedlings. Remove livestock from any area of an allotment when browsing indicates a change in livestock preference from grazing herbaceous vegetation to browsing woody riparian vegetation.	Range management analysis is not applicable to this project.
Riparian Conservation Objective #6: Identify and implement restoration actions to maintain, restore or enhance water quality and maintain, restore, or enhance habitat for riparian and aquatic species. (AMS goals: all)	

22. Recommend restoration practices in: (1) areas with compaction in excess of soil quality standards, (2) areas with lowered water tables, or (3) areas that are either actively down cutting or that have historic gullies. Identify other management practices, for example, road building, recreational use, grazing, and timber harvests, that may be contributing to the observed degradation.	Management practices and past disturbances that have caused degradation have been identified. These include old roads, skid trails, and landings. Restoration is proposed in areas with compaction in excess of soil quality standards, and at locations where disturbances are present and contributing to rill and gully erosion and sediment transport to streams and other aquatic features. Restoration activities include decommissioning of old roads, skid trails, and landings, increasing groundcover, and treating gullies and stabilizing streambanks. Long-term restoration activities are outside the scope of this project, but identified projects may be implemented under future projects.

Table developed from Standards and Guidelines on pages 62-66 of the 2004 SNFPA ROD.

Watersheds – Appendix J: Cumulative Watershed Effects Analysis

Cumulative Watershed Effects

Ground-disturbing activities have potential to cause impacts that persist through space and time. While one activity itself may not adversely impact the beneficial uses of water, the activity, when analyzed in connection with other past, present, and future activities across all ownerships within a watershed may lead to cumulative watershed effects (CWE).

With respect to the beneficial uses of water (described in the RCO analysis presented in Appendix A), the major concern of activities on forest land is sediment delivery to streams and associated degradation of aquatic habitat. The Pacific Southwest Region (Region 5) of the Forest Service has developed a standardized CWE analysis using the Equivalent Roaded Acres (ERA) method to assess the risk of increased sediment delivery to streams. This method was further refined and adapted for use on the Eldorado National Forest (ENF) (Carlson and Christiansen 1993).

ERA Methodology

In the ERA method, roads are considered to have the greatest potential to increase runoff and sediment delivery to streams. An index is calculated for each HUC7 watershed that depicts land use in terms of the percent of the watershed covered in roads. Roads are given a value of 1.0, and the acres of road surface in a watershed is multiplied by the index then divided by the size of the entire watershed to determine the percent of the watershed covered in roads.

Other land disturbing activities are given a number less than 1.0 depending on the expected impacts from each activity. The closer the number is to 1.0, the greater the likelihood that activity could contribute sediment to streams. The number of acres of each disturbance is multiplied by the index then divided by the size of the entire watershed. This gives the percent of the “equivalent roaded acres” in the watershed for each type of land disturbance. The values of equivalent roaded acres for all land disturbances within a watershed are added together, and the final number represents the percent of the watershed that is covered by the “equivalent” of roads.

In the ERA model, a Threshold of Concern (TOC) was developed for each watershed and is based upon watershed characteristics such as relief, geology, precipitation regime, and stream channel classification. The TOC is an estimate of the upper limit of watershed tolerance to disturbance, and generally ranges from 10-18 percent on the ENF. This means that when 10-18 percent of a watershed is covered in equivalent roaded acres, there is potential for measurable cumulative watershed effects. It is important to note that the TOC is not an exact point at which cumulative watershed effects will occur, or even that measureable effects will occur at all, it is merely a warning that cumulative effects might occur.

Assumptions and Limitations

- The ERA method is intended for watersheds between 3,000 and 10,000 acres in size, although it is commonly used for watersheds slightly outside of this range.
- ERA values, as well as the TOC, are only indicators of the risk of cumulative impacts occurring. They cannot be used to determine the percent or numerical amount of increase of sediment delivery to streams, stream channel eroded, fish habitat degraded or lost, or any other change in watershed condition.
- The location of land disturbance activities within a watershed is not considered. For example, roads near streams are treated exactly the same as roads that are far from streams. In reality, roads located near streams contribute more sediment to streams than roads in upland areas.

Risk Categories

- Low risk of CWE – ERA is less than 50 percent of TOC
- Moderate risk of CWE – ERA is 50 to 80 percent of TOC

- High risk of CWE – ERA is between 80 and 100 percent of TOC
- Very high risk of CWE – ERA is greater than 100 percent of TOC

Watersheds Impacted by the King Fire

The King Fire burned within 33 HUC7 watersheds (Table 1, Figure 1). Burn severity varied widely across the watersheds – see the Hydrology section of the EIS for further detail of burn severity within each watershed.

Table 1. Total Acres of Each HUC7 and Total Acres and Percent of Each HUC7 Within the Fire Perimeter. Hydrologic Unit Code identifiers are also presented.

HUC 7	HUC7 Total Area (acres)	HUC7 within Fire (acres)	HUC7 within Fire (%)
Big Grizzly Canyon (18020128020605)	6,222	2,252	52
Brush Creek (18020129050302)	5,215	5,215	100
French Meadows Reservoir (18020128010105)	6,222	58	1
Gerle Creek (18020128020303)	7,137	150	2
Headwaters Slab Creek (18020129050301)	8,697	6,431	74
Little Silver Creek (18020129040205)	8,581	151	2
Long Canyon – South Fork American River (18020129050305)	2,871	4	<1
Lower Pilot Creek (18020129050303)	9,823	234	2
Lower Silver Creek (18020129040403)	6,646	6,320	95
Lower Slab Creek (18020129050303)	5,496	5,297	96
Lower South Fork Rubicon River (18020128020305)	6,044	2,049	34
Middle Fork American River – Chipmunk Creek (18020128010106)	7,285	15	<1
Middle Long Canyon (18020128020404)	6,142	762	12
North Fork Long Canyon Creek (18020128020402)	4,197	676	16
One Eye Creek (18020129050105)	4,523	7	<1
Onion Creek (18020129040402)	3,351	2,944	88
Pilot Creek – Stumpy Meadows Reservoir (18020128020501)	9,562	4,823	50
Rubicon River – Ellicott Bridge (18020128020601)	7,966	7,403	93
Rubicon River – Hell Hole Reservoir (18020128020206)	11,268	777	7
Rubicon River – Leonardi Springs (18020128020603)	7,140	7,139	100
Rubicon River – Pigeon Roost Canyon (18020128020604)	7,077	4,824	68
HUC 7	HUC7 Total Area (acres)	HUC7 within Fire (acres)	HUC7 within Fire (%)
Rubicon River – Stoney Creek (18020128020602)	7,305	5,740	79
Silver Creek – Camino Reservoir (18020129030205)	12,344	10,152	82
Soldier Creek (18020129030205)	3,563	3,293	92
South Fork American River – Brockliss Canyon (18020129030204)	11,082	1,056	10

South Fork American River – Fresh Pond (18020129030206)	7,026	4,667	66
South Fork American River – Slab Creek Res. (18020129050304)	6,722	4,473	67
South Fork Long Canyon Creek (18020128020401)	7,121	4,442	62
South Fork Silver Creek – Junction Reservoir (18020129040303)	11,521	<1	<1
Upper Chile (18020129050307)	8,306	<1	<1
Upper Gerle Creek (18020128020302)	7,941	39	<1
Wallace Canyon (18020128020403)	8,353	5,957	71
Whaler Creek (18020129050101)	8,306	61	1

Methodology Specific to the King Fire Salvage Project

Current Conditions

Recovery of a watershed from land-disturbing activities occurs with time. For timber harvest activities, hydrologic recovery is assumed to be 30 years (i.e., ERA contribution is 0-30 years after timber harvest). A three-year average recovery period was used for areas of moderate soil burn severity, and a seven-year average recovery period was used for areas of high soil burn severity. Note that these are the same values used for CWE analysis on the Rim Fire (Stanislaus National Forest and Yosemite National Park) and the American Fire (Tahoe National Forest) salvage logging projects, both of which are located nearby the King Fire in areas with similar watershed and climate characteristics. It was assumed that areas of low burn severity would have a similar watershed response as unburned areas. The ERA calculations do not take into account site-specific BMPs that would be applied. ERA values start one year after a land use is implemented.

Cumulative watershed effects for Alternative 5 are the same as for Alternative 2 as differences in the proposed actions between Alternative 2 and Alternative 5 are negligible in terms of cumulative watershed impacts.

For non-National Forest System Lands it was assumed that all areas with 10 percent or more vegetation mortality would be treated through mechanical salvage/biomass removal, except for plantations established within the past 10 years, which would not require treatment.

All activities on Forest Service land within the HUC7 watersheds affected by proposed project activities of the King Fire Restoration Project were updated using the Forest Service Activity Tracking System (FACTS) database. The most recent, most impactful treatment was used to calculate existing treatment activities. Some treatments may overlap despite efforts to minimize double counting treatments on acres where compounding effects from treatment were likely, such as counting two thins on the same acre accounted for in FACTS as different accomplishments for the same time period, or a clear cut followed by a thin 20 years later. Where high or moderate severity fire effects to soil resulted, that was considered the most impactful treatment. Existing landings and skid roads in areas of high severity fire effects were assumed to continue to have an impact and were retained in the worksheets for each HUC 7 watershed.

All activities on non-National Forest System land ownerships in the HUC7 watersheds affected by proposed project activities on the King Fire Restoration Project were determined using CALFire Timber Harvest Plan (THP) data. Some treatments may overlap in these treatments, such as a thinning that was later clear cut or thinned again. Again, high and moderate severity fire effects to soil were assumed to be the most impactful treatment when calculating current watershed conditions.

All existing roads and trails were included in the worksheet. Range allotments were not updated due to time limitations and the overwhelming impact of the fire relative to impacts from grazing.

Future Conditions

The most recent Schedule of Proposed Actions was used to determine proposed activities on NFS lands, and the FACTS database was used to determine how many activities from past projects on NFS lands have yet to be completed. The estimation of number of new landings to be constructed, as calculated by the ERA spreadsheets, was reduced by 66 percent due to re-use of existing landings.

For non-National Forest System lands it was assumed that all areas with 10 percent or more vegetation mortality would be treated through mechanical salvage/biomass removal, except for plantations established within the past 10 years, which would not require treatment.

Watersheds Excluded from Analysis

Eleven of the 33 watersheds had less than two percent of the total area impacted by the fire, and therefore were not analyzed due to the small acreage within the fire perimeter. In addition, the Onion Creek Watershed was also excluded from analysis as it contains no Forest Service land and therefore has no proposed activities under this project. The following watersheds were excluded from further analysis:

- French Meadows Reservoir
- Gerle Creek
- Little Silver Creek
- Long Canyon – South Fork American River
- Lower Pilot Creek
- Middle Fork American River – Chipmunk Creek
- One Eye Creek
- Onion Creek
- South Fork Silver Creek – Junction Reservoir
- Upper Chile
- Upper Gerle Creek
- Whaler Creek

Summary of Results

The ERA model was run for the years 2015, 2016, 2020, and 2025. The results of ERA analysis, expressed as the percentage of the TOC, are presented in Table 2. When the percentage of TOC is 100 percent or greater, that watershed has a very high risk of CWE and is considered to be “over threshold.” Table 2 and Figure 2 present a summary of the number of watersheds that fall within each risk category by alternative for each year analyzed. Watersheds over threshold are highlighted in grey in Table 2, and colored red in Figure 2.

In general, there is little difference in the number of watersheds over threshold between the alternatives for each year of interest, despite substantial differences in the extent of ground-disturbing treatment activities in some watersheds. These results are consistent with the results of Chou et al. (1994) and McIver and Star (2001), who found no differences in sediment output between logged and unlogged burned areas, which they suggested was because sediment produced from logging was overwhelmed by sediment produced from the fire itself. The results of the King Fire CWE analysis also agree with Peterson et al. (2009), who, in a synthesis of the effects of post-fire logging in western North America, suggested that because post-fire logging takes place in areas where the canopy and soil have already been modified, it is reasonable to conclude that logging would not add significantly to the already altered landscape.

Table 2. Equivalent Roaded Acres Expressed as the Percentage of the TOC for HUC7 Watersheds Impacted by the Fire for Each Alternative During 2015, 2016, 2020, and 2025.

When the percentage of TOC is 100 percent or greater, that watershed has a very high risk of CWE and is considered to be "over threshold." Watersheds over threshold are highlighted in grey.

HUC 7	Alt	2015 % TOC	2016 % TOC	2020 % TOC	2025 % TOC
Big Grizzly Canyon *TOC = 14 percent*	1	209	171	139	126
	2		225	177	154
	3		225	177	154
	4		228	179	156
Brush Creek *TOC = 14 percent*	1	183	126	72	46
	2		161	95	64
	3		149	86	57
	4		172	104	72
Headwaters Slab Creek *TOC = 10 percent*	1	187	308	161	136
	2		308	190	136
	3		307	189	136
	4		308	190	136
Lower Silver Creek *TOC = 12 percent*	1	185	132	64	32
	2		152	78	45
	3		136	67	36
	4		161	87	54
Lower Slab Creek *TOC = 10 percent*	1	85	139	106	87
	2		147	111	92
	3		142	108	89
	4		168	127	105
Lower South Fork Rubicon River *TOC = 10 percent*	1	41	40	32	27
	2		41	32	27
	3		40	32	27
	4		47	37	31
Middle Long Canyon *TOC = 14 percent*	1	35	46	51	47
	2		46	52	48
	3		46	52	48
	4		46	52	48
North Fork Long Canyon Creek *TOC = 14 percent*	1	65	61	52	47
	2		61	52	47
	3		61	52	47
	4		62	53	47
HUC 7	**Alt**	**2015 % TOC**	**2016 % TOC**	**2020 % TOC**	**2025 % TOC**
Pilot Creek – Stumpy Meadows Reservoir *TOC = 16 percent*	1	123	112	87	65
	2		119	96	85
	3		117	94	84
	4		119	96	85
Rubicon River – Ellicott Bridge *TOC = 10 percent*	1	216	150	62	20
	2		170	75	32
	3		168	74	30
	4		173	78	33

Rubicon River – Hell Hole Reservoir *TOC = 12 percent*	1	19	18	15	14
	2		19	16	14
	3		19	16	14
	4		19	16	14
Rubicon River – Leonardi Spring *TOC = 10 percent*	1	419	356	296	289
	2		428	335	293
	3		418	328	287
	4		449	351	307
Rubicon River – Pigeon Roost Canyon *TOC = 10 percent*	1	155	139	112	100
	2		155	122	107
	3		153	121	106
	4		154	122	108
Rubicon River – Stony Creek *TOC = 14 percent*	1	212	193	160	142
	2		202	166	146
	3		202	166	151
	4		210	172	152
Silver Creek – Camino Reservoir *TOC = 10 percent*	1	163	199	124	89
	2		193	130	102
	3		179	121	94
	4		208	143	114
Soldier Creek *TOC = 12 percent*	1	227	227	119	78
	2		196	113	76
	3		186	107	72
	4		198	117	80
South Fork American River – Brockliss Canyon *TOC = 10 percent*	1	88	88	72	62
	2		82	69	61
	3		82	69	61
	4		85	71	63
South Fork American River – Fresh Pond Ravine *TOC = 10 percent*	1	177	167	96	63
	2		151	93	66
	3		150	93	66
	4		157	97	70
South Fork American River – Slab Creek Reservoir *TOC = 10 percent*	1	138	137	108	95
	2		156	118	102
	3		147	112	97
	4		173	133	114

HUC 7	Alt	2015 % TOC	2016 % TOC	2020 % TOC	2025 % TOC
South Fork Long Canyon Creek *TOC = 16 percent*	1	83	93	71	62
	2		98	74	64
	3		96	73	63
	4		102	78	67
Wallace Canyon *TOC = 14 percent*	1	232	198	159	140
	2		259	201	175
	3		251	195	170

	4		260	202	176

Table 3. Number of HUC7 Watersheds That Fall Within Each Risk Category by Each Alternative for 2015, 2016, 2020, and 2025, as Calculated from the ERA Methodology

Year	Alternative	Low Risk	Moderate Risk	High Risk	Very High Risk (over threshold)
2015	All	3	2	2	14
2016	1	3	1	2	15
	2	3	1	2	15
	3	3	1	2	15
	4	3	1	1	16
2020	1	2	7	3	9
	2	2	6	4	9
	3	2	6	4	9
	4	2	5	4	10
2025	1	7	5	2	7
	2	6	5	1	9
	3	6	5	3	7
	4	5	6	1	9

Results for Each Alternative

Alternative 1

In 2015, 14 of the 21 watersheds analyzed had a very high risk (over threshold) of CWEs under all alternatives (Figure 3) as a result of the fire itself and past and present activities on public and private land.

The watersheds over threshold are:

- Big Grizzly Canyon
- Brush Creek
- Headwaters Slab Creek
- Lower Silver Creek
- Pilot Creek – Stumpy Meadows Reservoir
- Rubicon River – Ellicott Bridge
- Rubicon River – Leonardi Springs
- Rubicon River – Pigeon Roost Canyon
- Rubicon River – Stoney Creek
- Silver Creek – Camino Reservoir
- Soldier Creek
- South Fork American River – Fresh Pond Ravine
- South Fork American River – Slab Creek Reservoir
- Wallace Canyon

In 2016, the number of watersheds with a very high risk increases to 15 (addition of Lower Slab Creek) under Alternative 1 (Figure 4) due to a combination of the impacts of the fire itself and salvage logging on private land. The number of watersheds with a very high risk under Alternative 1 decreases in 2020 (Figure 5) due to recovery of burned areas and areas of private land that were salvage logged. The following watersheds remain over threshold in 2020:

- Big Grizzly Canyon
- Headwaters Slab Creek
- Lower Slab Creek
- Rubicon River – Ellicott Bridge
- Rubicon River – Leonardi Springs
- Rubicon River – Pigeon Roost Canyon
- Rubicon River – Stoney Creek
- Silver Creek – Camino Reservoir
- Soldier Creek
- South Fork American River – Slab Creek Reservoir
- Wallace Canyon

In 2025, one watershed (Silver Creek – Camino Reservoir) is no longer over threshold (Figure 6); the other watersheds listed for 2020 remain over threshold in 2025.

The results of CWE analysis for Alternative 1 demonstrate that the fire itself and salvage logging on private land caused multiple watersheds to be over threshold and have a high risk of cumulative watershed effects.

Alternative 2

For the years 2015 (Figure 7), 2016 (Figure 8), and 2020 (Figure 9), the same watersheds remain over threshold as under Alternative 1 (No Action) despite the proposed addition of potentially ground-disturbing treatments on 17,227 acres (Table 2.1 of the DEIS). This is likely the result of sediment produced from post-fire logging activities being overwhelmed by sediment produced by the fire itself, which is supported by the results of Chou et al. (1994), McIver and Star (2001) and Peterson et al. (2009).

In 2025, two watersheds remain over threshold (Silver Creek – Camino Reservoir and South Fork American River – Slab Creek Reservoir) as compared to Alternative 1 (although both of these watersheds exceed the TOC by only 2%). This is likely in response to quicker recovery times for fire compared to salvage logging.

Alternative 3

The same watersheds over threshold under Alternative 1 (No Action) remain over threshold under Alternative 3 for all years of analysis (Figures 10-12).

Compared to Alternative 2 (Proposed Action), Alternative 3 reduces the amount of land to be logged with fairly large reductions in some watersheds. However, cumulative effects are expected to be similar, which is supported by studies that concluded that sediment production from post-fire logging is overwhelmed by sediment produced by the fire itself (Chou et al. 1994; McIver and Star 2001; Peterson et al. 2009).

Alternative 4

Compared to Alternative 1 (No Action), the same watersheds are over threshold under Alternative 4 in 2015 (Figure 3). In 2016, one additional watershed remains over threshold (South Fork Long Canyon Creek, Figure 13) compared to Alternative 1. One additional watershed remains over threshold in 2020 compared to Alternative 1 (Brush Creek, Figure 14). In 2025, one additional watershed remains over threshold (Lower Slab Creek, Figure 15) compared to Alternative 1. In all cases, these watersheds are over the TOC by five percent or less.

Compared to Alternative 2 (Proposed Action), Alternative 4 increases the amount of land to be logged with fairly high increases in some watersheds. However, cumulative effects are expected to be similar, which is supported by studies that concluded that sediment production from post-fire logging is overwhelmed by sediment produced by the fire itself (Chou et al. 1994; McIver and Star 2001; Peterson et al. 2009).

Alternative 5

Cumulative watershed effects were not assessed separately for Alternative 5 as the reduction in herbicide use would not impact hydrologic response at the HUC7 watershed scale. Therefore, cumulative watershed impacts would be the same as those described for Alternative 2.

Figure 1. HUC7 Watersheds in Which the King Fire Burned

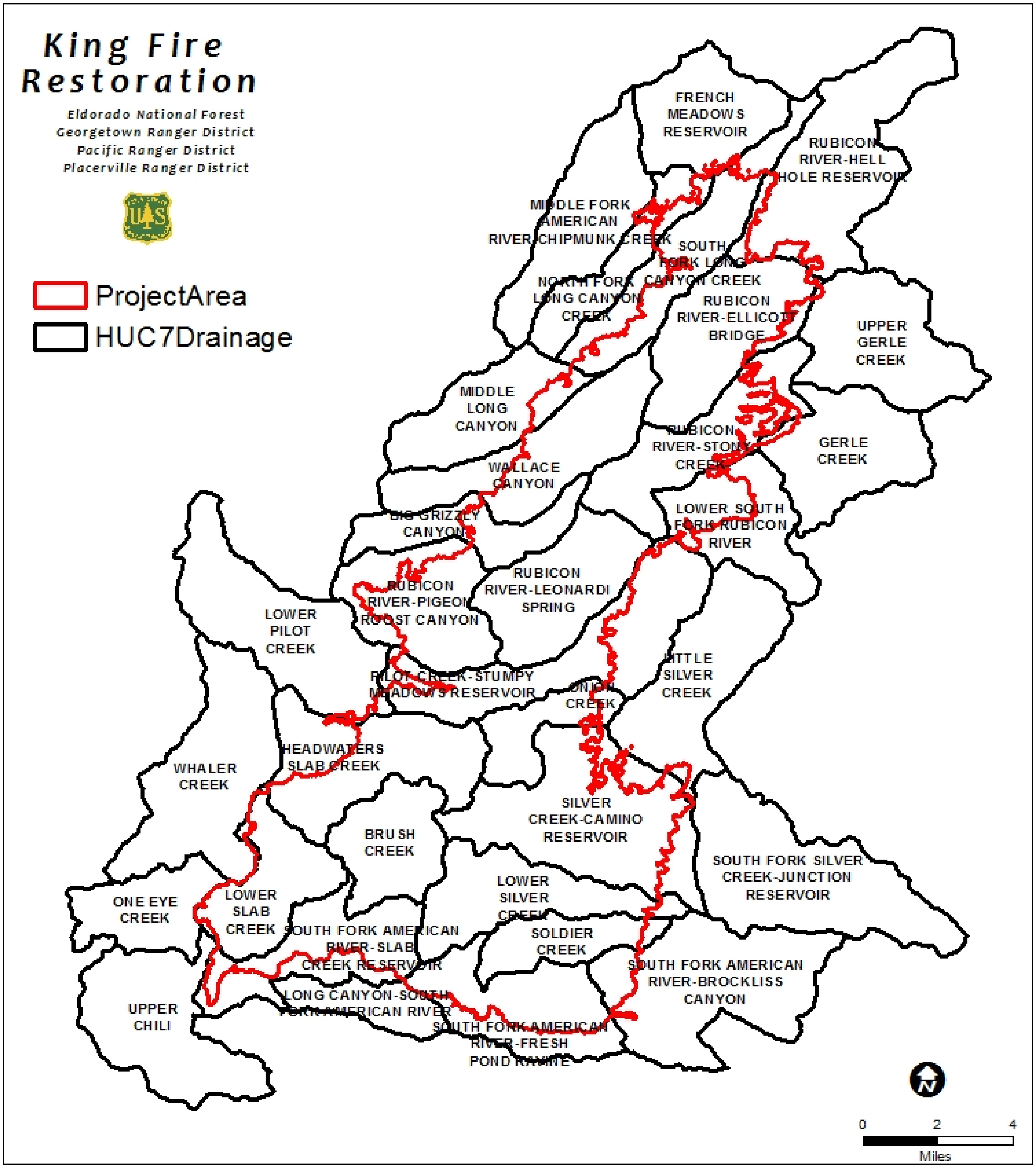


Figure 2. Number of Watersheds Within Each Risk Category for Cumulative Watershed Effects by Alternative for the Years 2015, 2016, 2020, and 2025

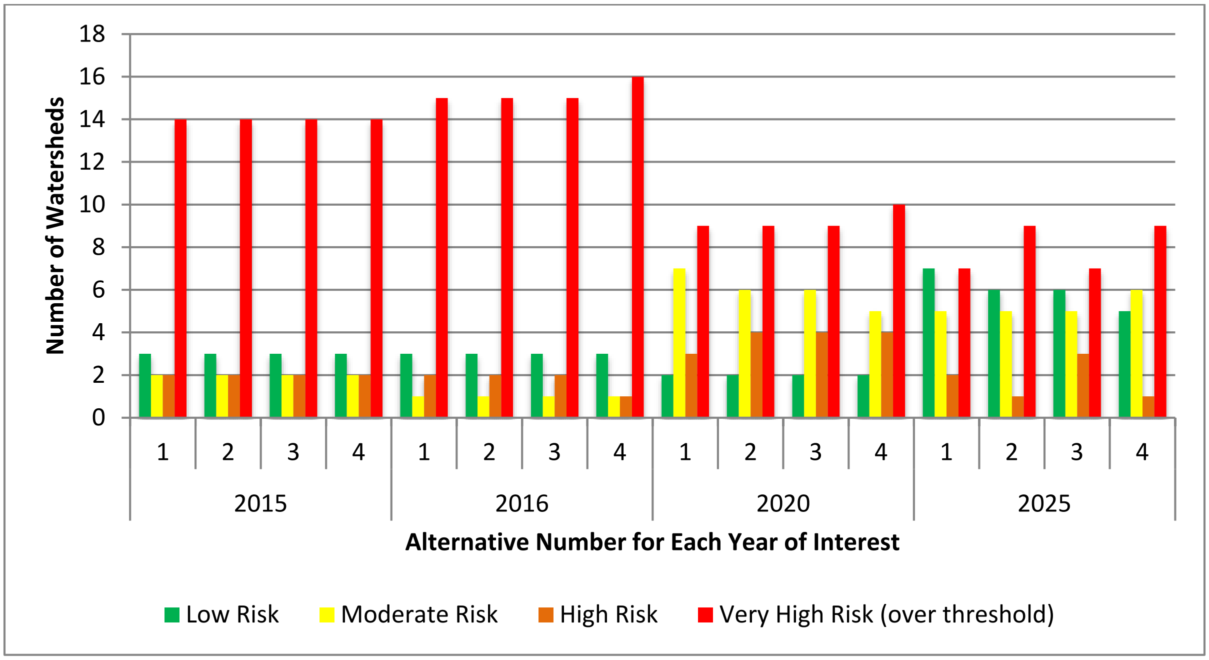


Figure 3. Risk of CWE in 2015 for All Alternatives

Watersheds In Red Are Considered To Be "Over Threshold."

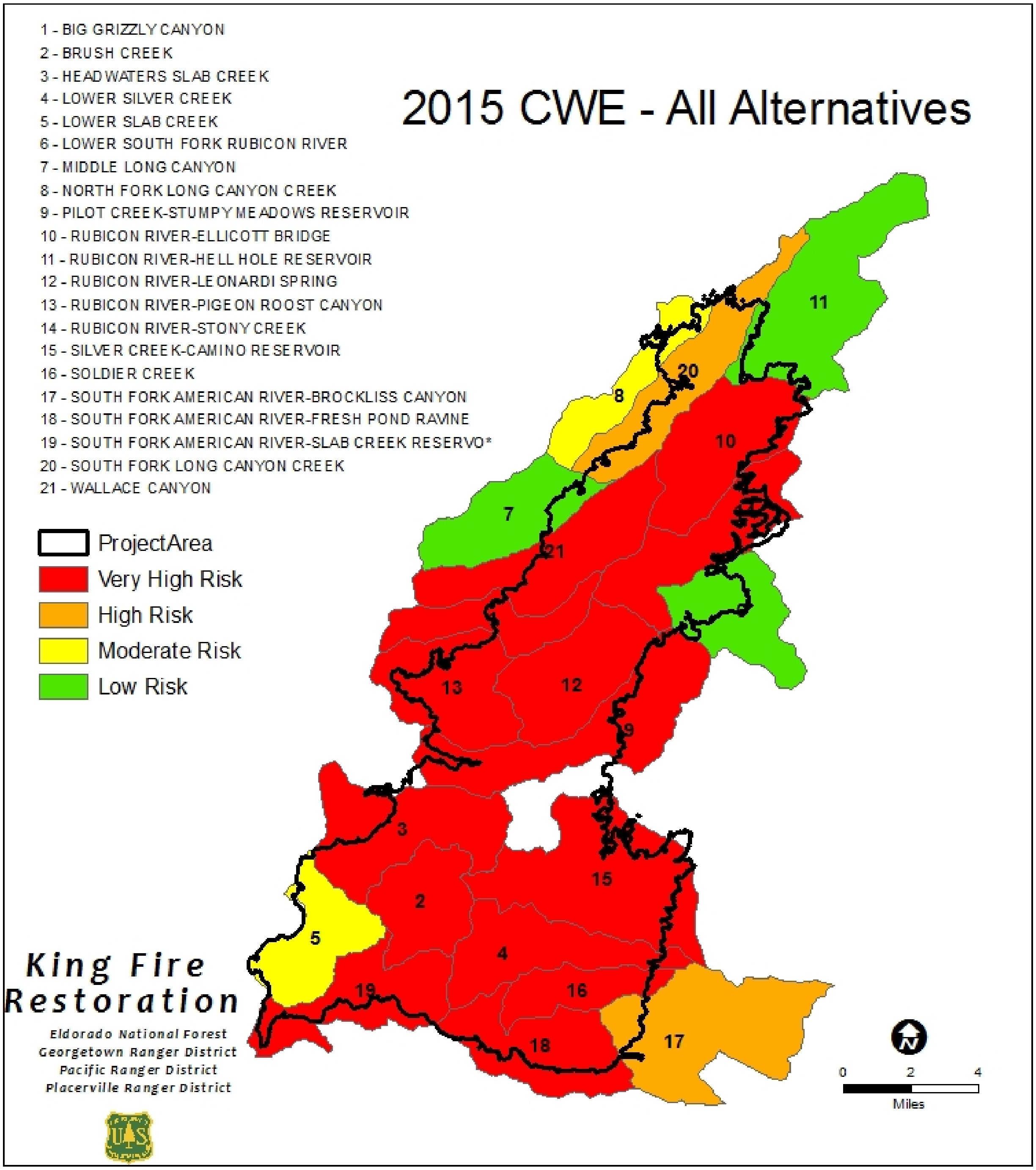


Figure 4. Risk of CWE in 2016 for Alternative 1 (No Action)

Watersheds in red are considered to be "over threshold."

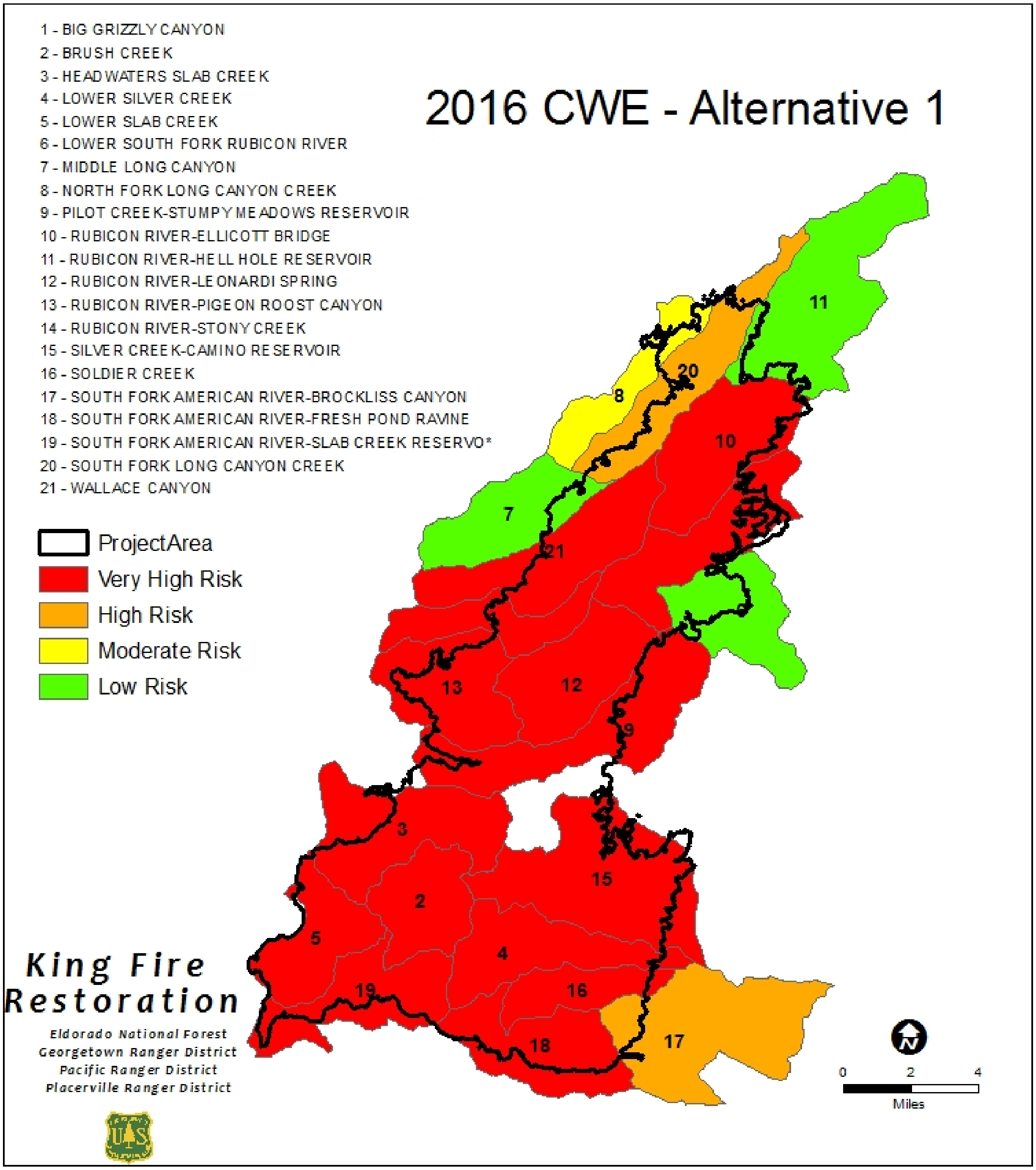


Figure 5. Risk of CWE in 2020 for Alternative 1 (No Action)

Watersheds in red are considered to be "over threshold."

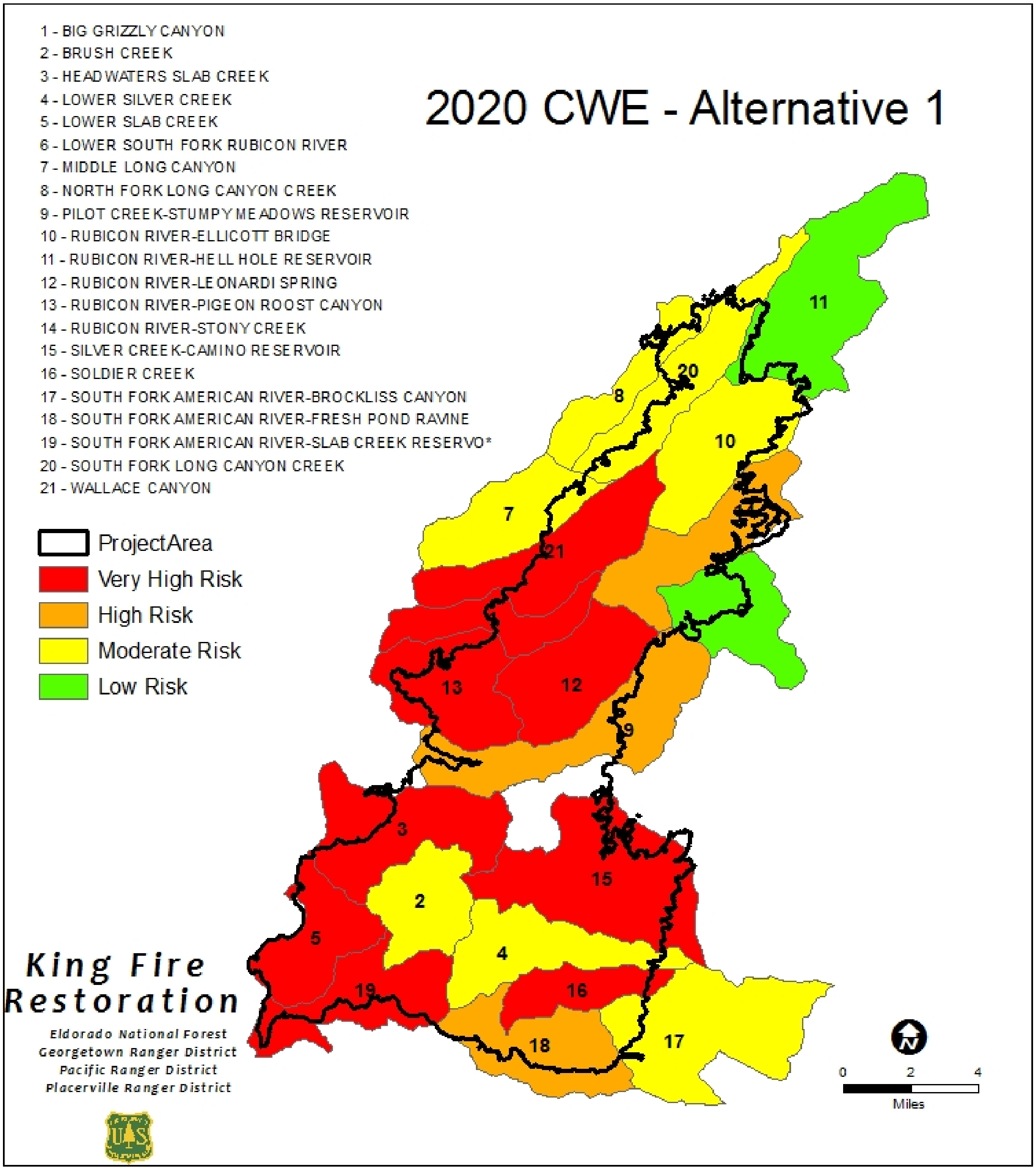


Figure 6. Risk of CWE in 2025 for Alternative 1 (No Action)

Watersheds in red are considered to be "over threshold."

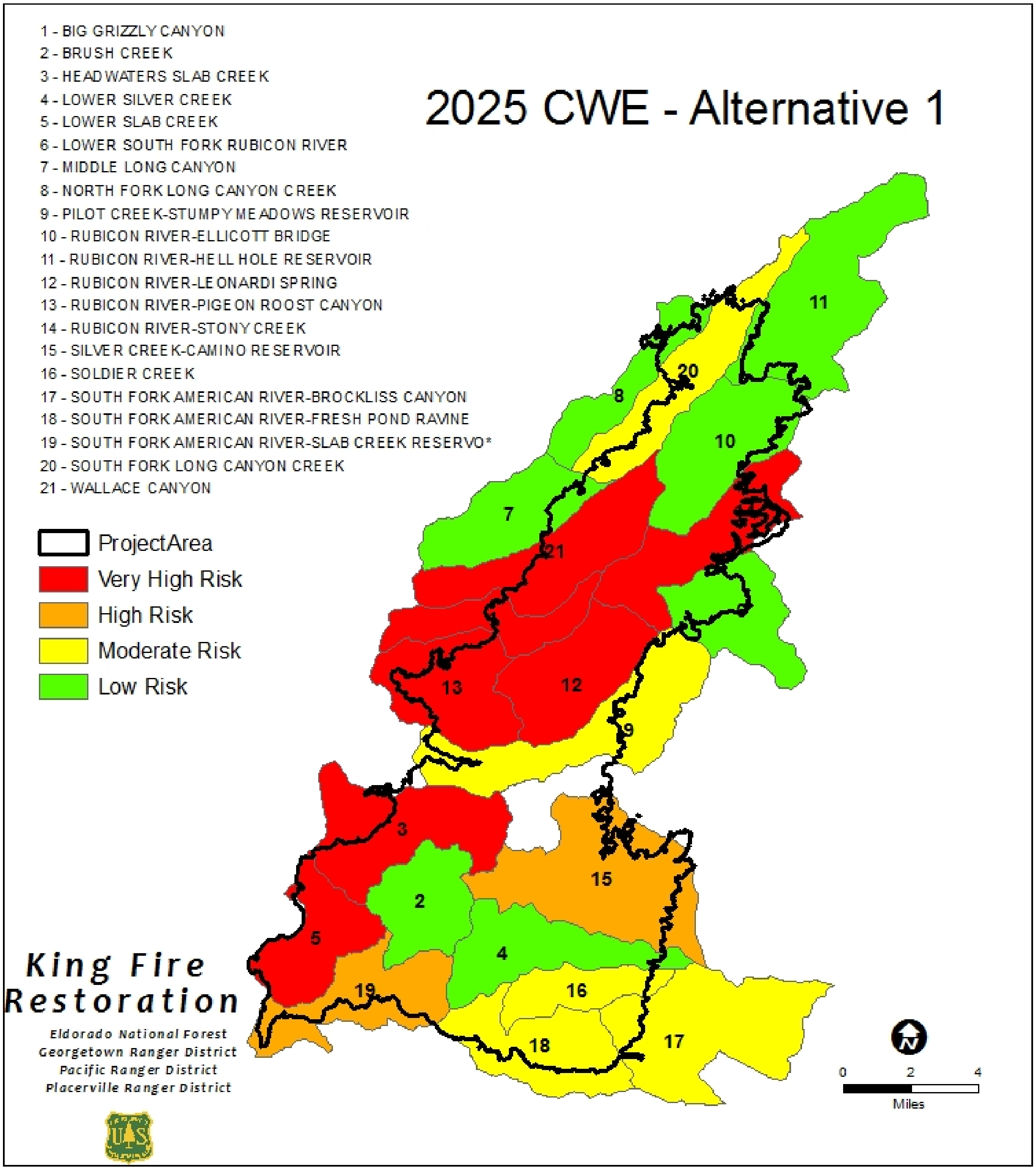


Figure 7. Risk of CWE in 2016 for Alternative 2 (Proposed Action)

Watersheds in red are considered to be "over threshold."

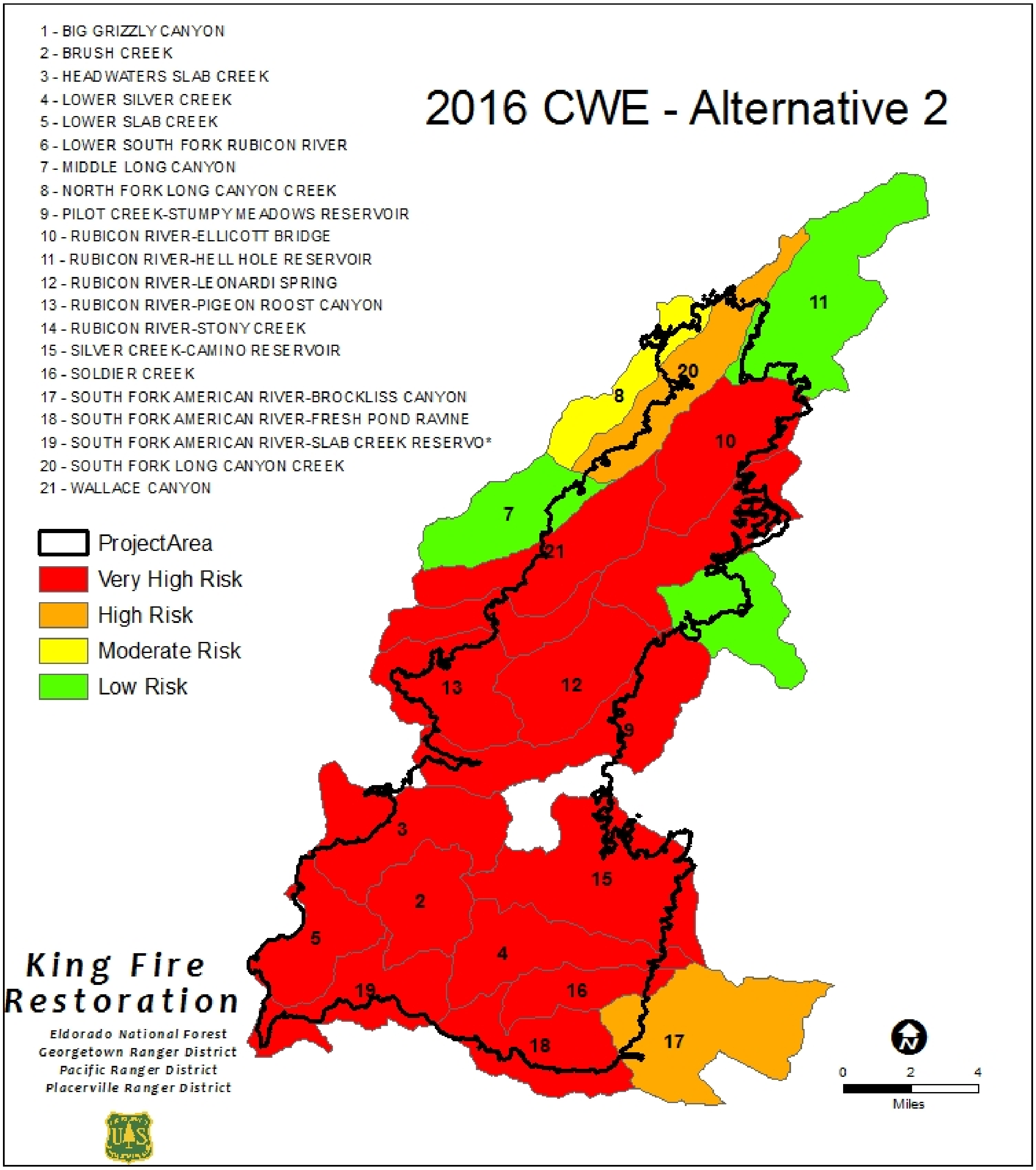


Figure 8. Risk of CWE in 2020 for Alternative 2 (Proposed Action)

Watersheds in red are considered to be "over threshold."

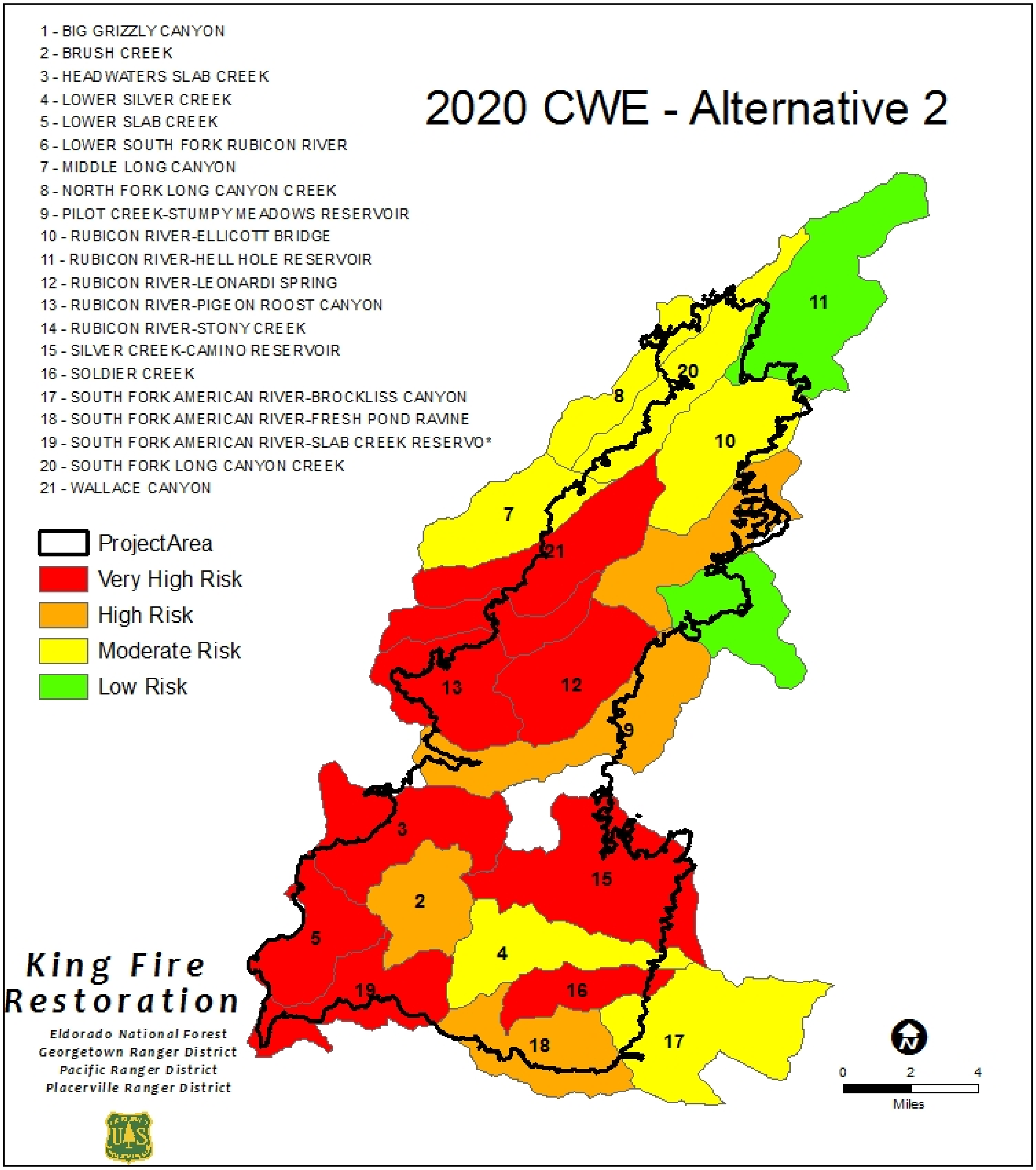


Figure 9. Risk of CWE in 2025 for Alternative 2 (Proposed Action)

Watersheds in red are considered to be "over threshold."

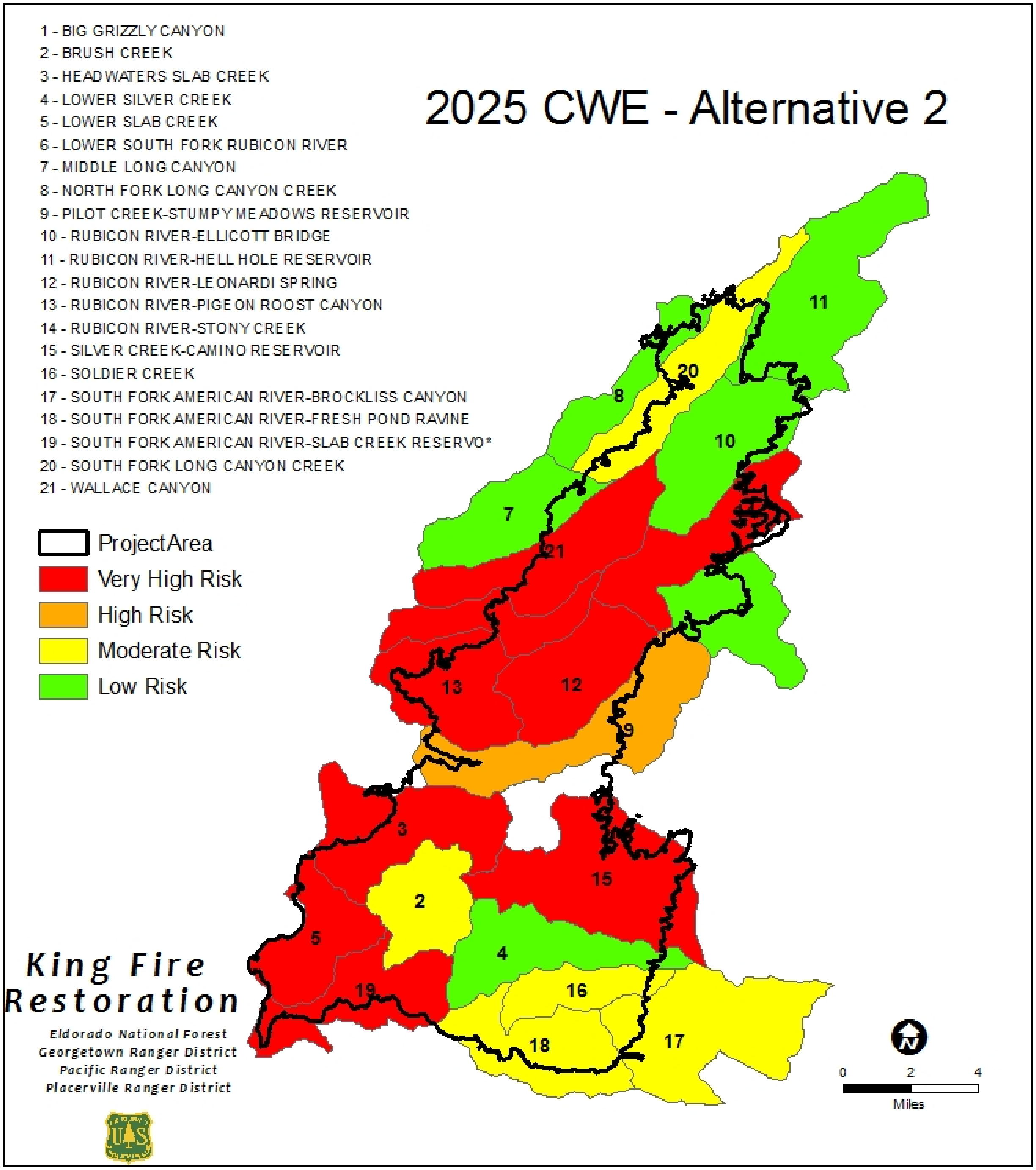


Figure 10. Risk of CWE in 2016 for Alternative 3

Watersheds in red are considered to be "over threshold."

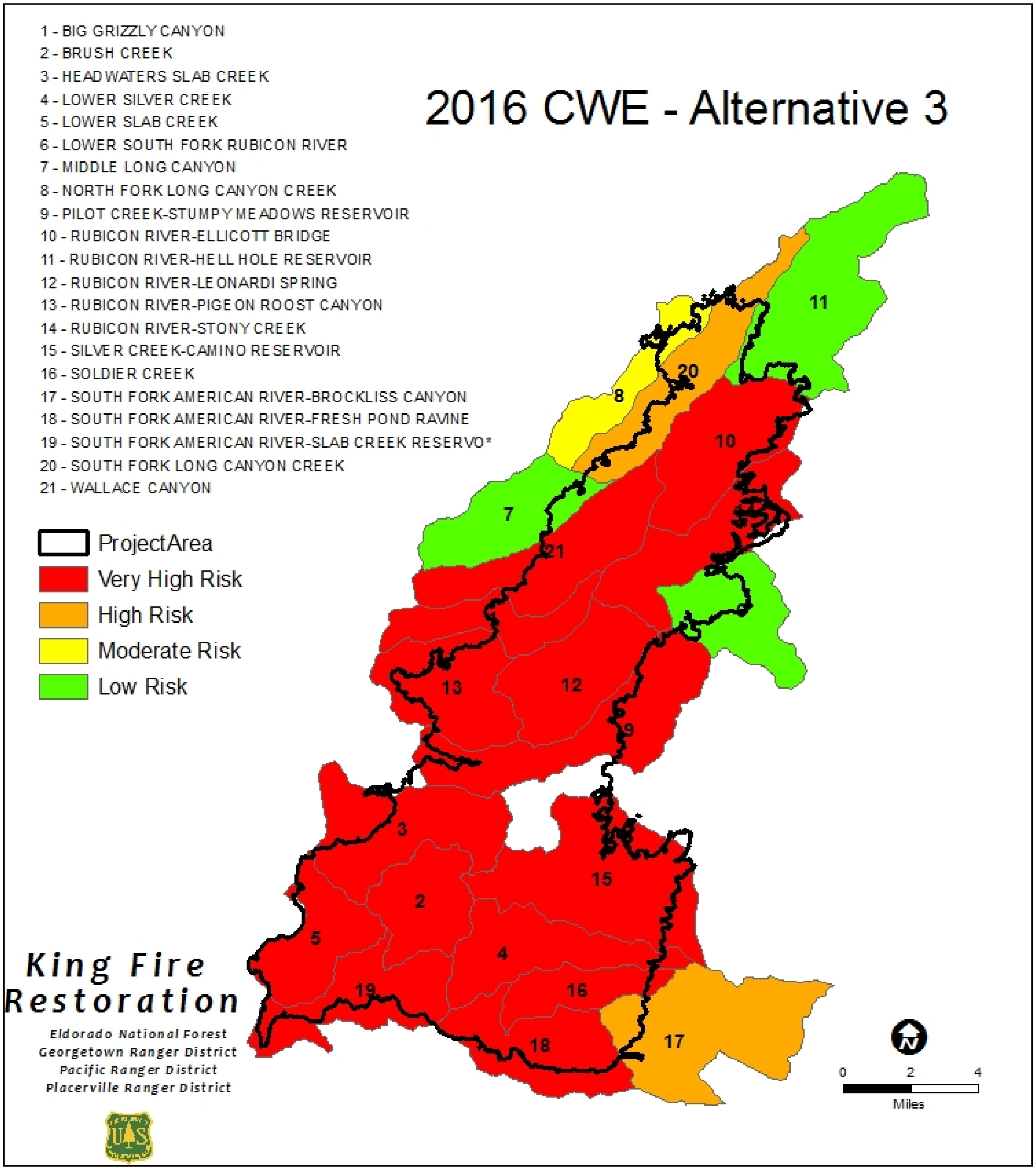


Figure 11. Risk of CWE in 2020 for Alternative 3

Watersheds in red are considered to be "over threshold."

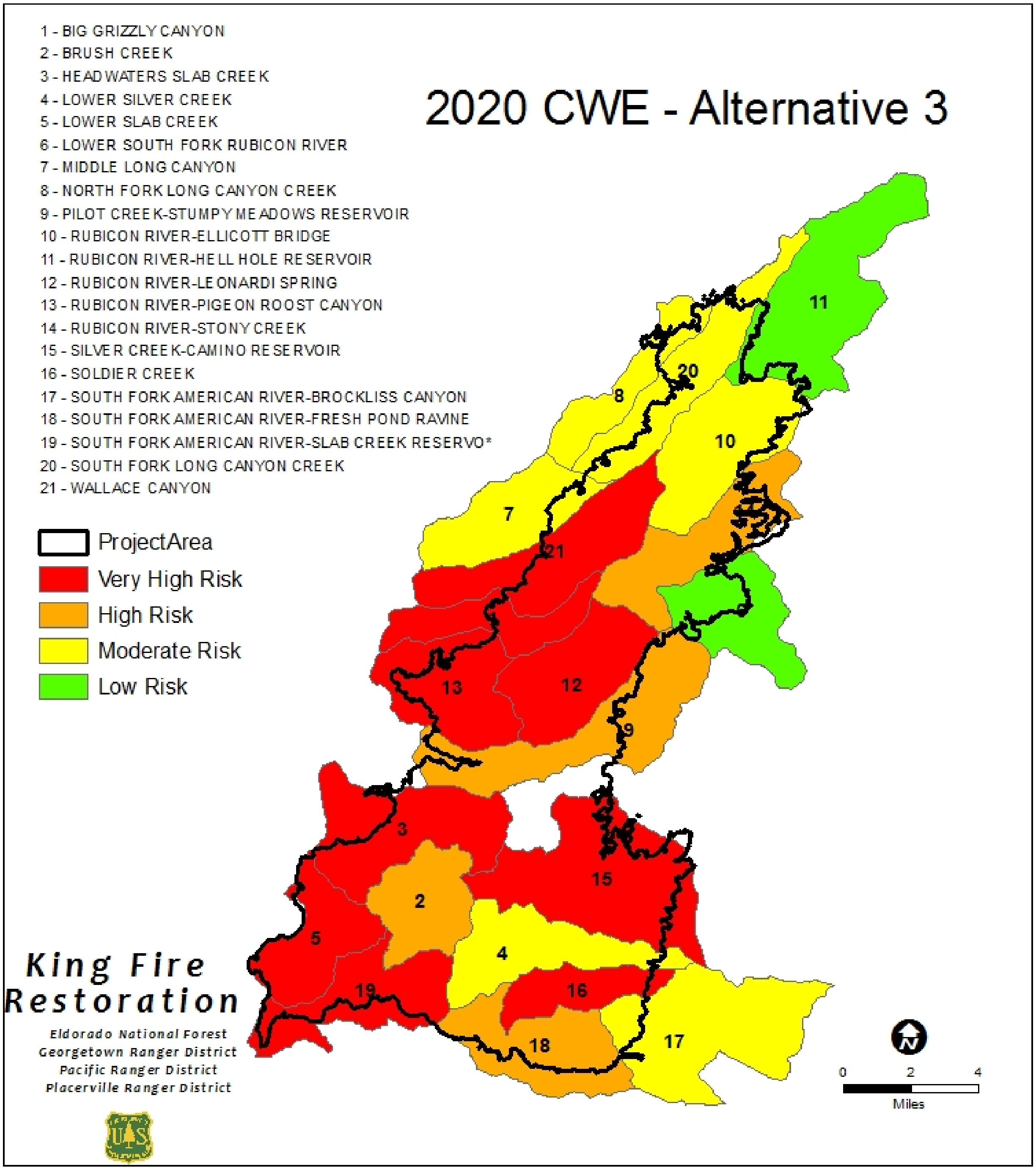


Figure 12. Risk of CWE in 2025 for Alternative 3

Watersheds in red are considered to be "over threshold."

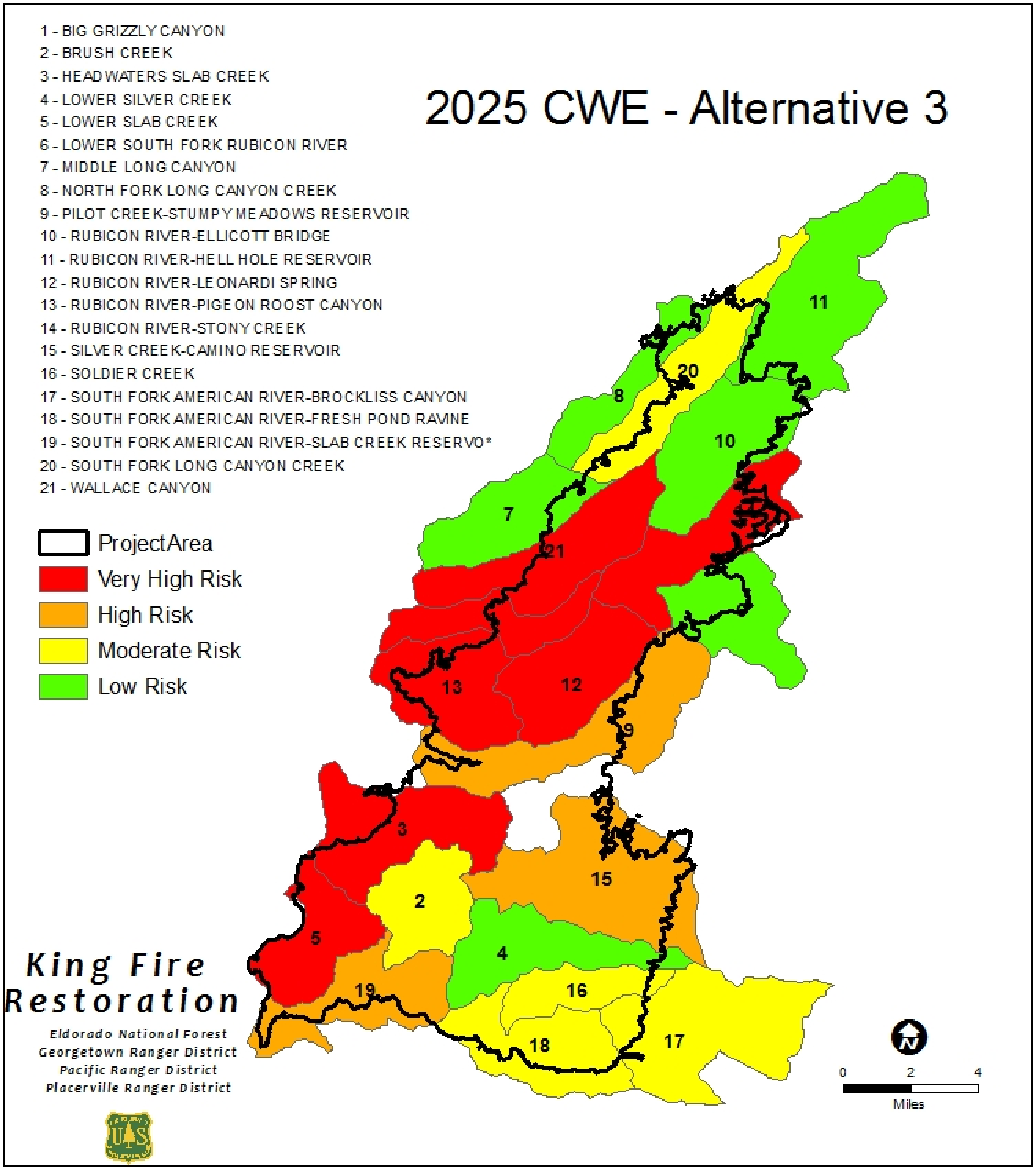


Figure 13. Risk of CWE in 2016 for Alternative 4

Watersheds in red are considered to be "over threshold."

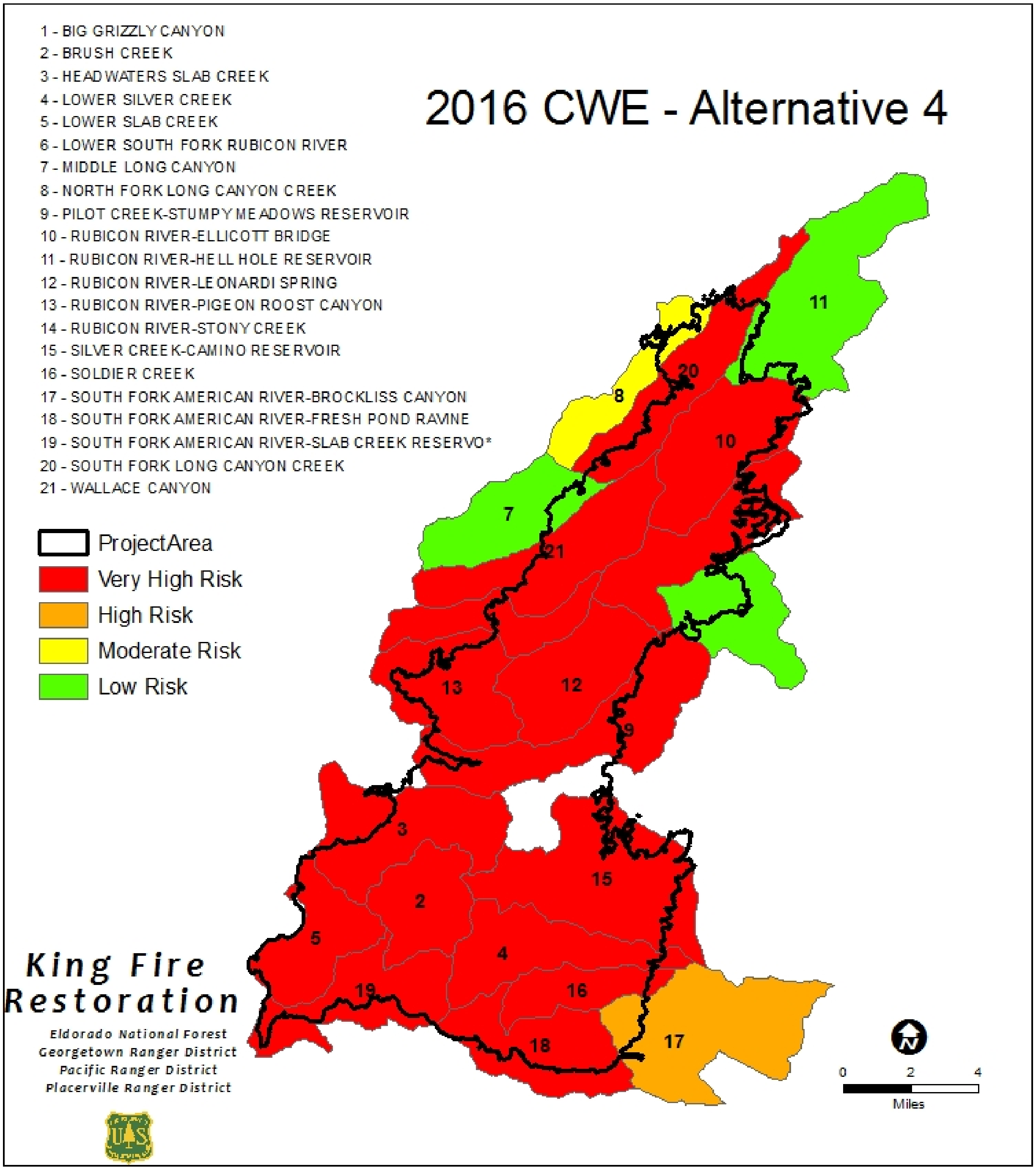


Figure 14. Risk of CWE in 2020 for Alternative 4

Watersheds in red are considered to be "over threshold."

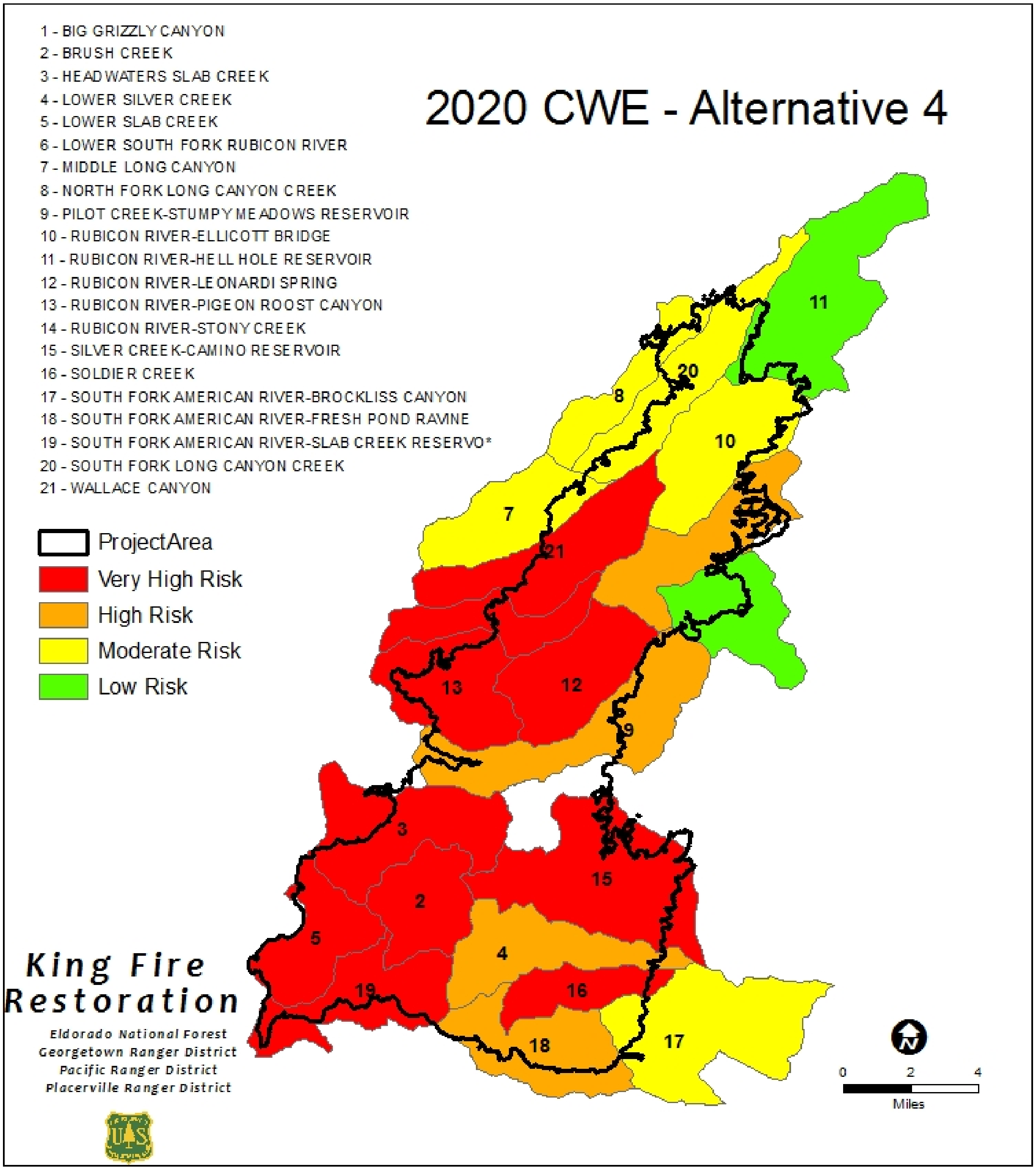
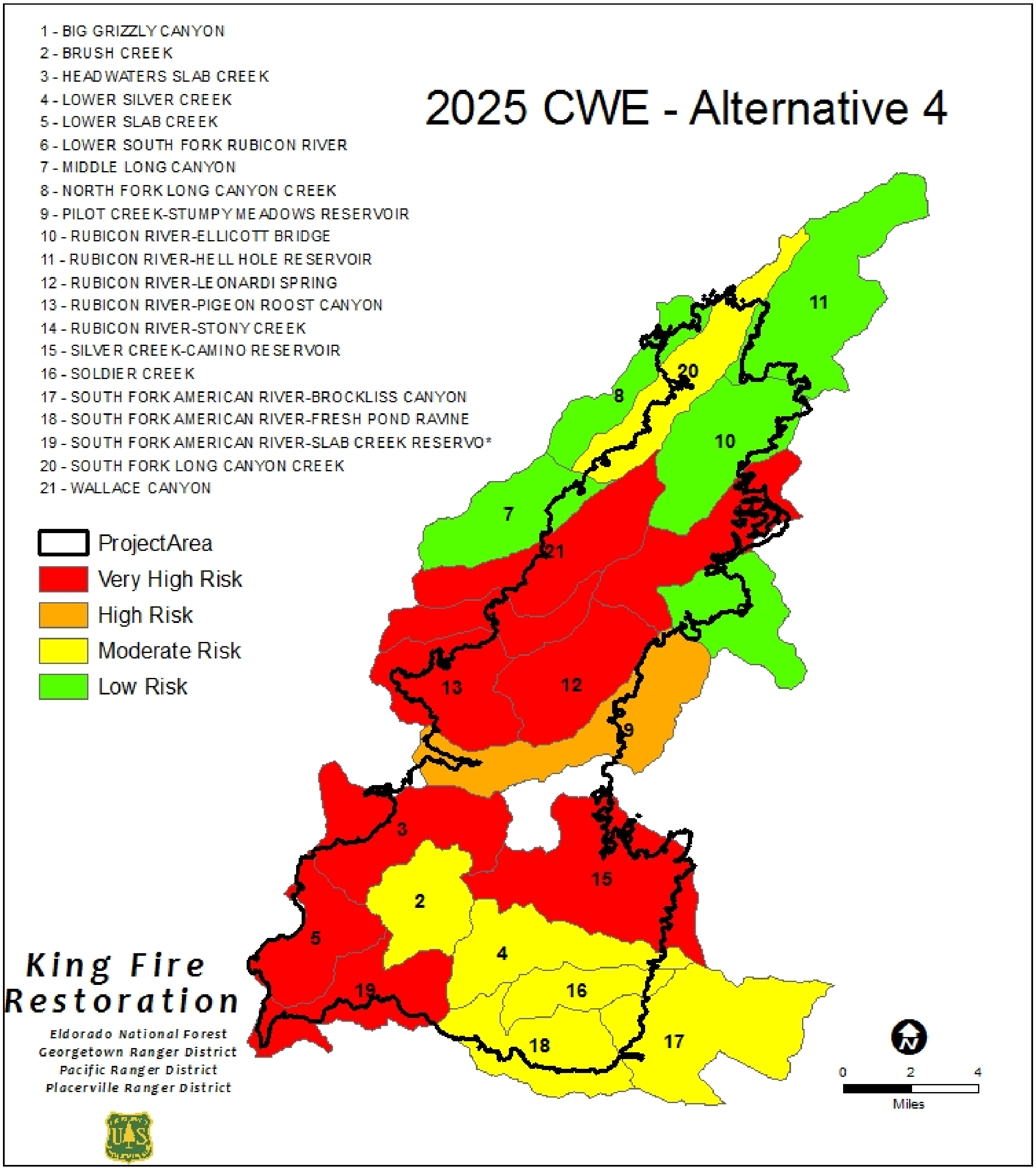


Figure 15. Risk of CWE in 2025 for Alternative 4

Watersheds in red are considered to be "over threshold."



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APPENDIX K

Watershed Monitoring Plan
King Fire Restoration Project
Eldorado National Forest

Vince Pacific
Hydrologist
April 8, 2015

Introduction

This document describes the Watershed Monitoring Plan for the King Fire Restoration Project. Project analysis identified a need to conduct monitoring within the project area to ensure that Water Quality Best Management Practices (BMPs) and management requirements are implemented and effective at protecting water quality.

Implementation, Effectiveness, and Forensic Monitoring

A Conditional Waiver of Waste Discharge Requirements for Discharges Relating to Timber Harvest Activities is issued to the Forest Service by the Central Valley Regional Water Quality Control Board (Water Board). These waivers are required for all timber harvest activities that will or will likely discharge waste that could affect the quality of the waters of the State.

In order to meet the conditions of the waiver, the Eldorado National Forest must conduct monitoring in accordance with the Monitoring and Reporting Program required by the Water Board under Order No. R5-2014-0144. This includes implementation, effectiveness, and forensic monitoring. Implementation monitoring would be required throughout all sale areas. Effectiveness and forensic monitoring would be required only in watersheds which exceed a threshold of concern (TOC), as determined during the cumulative watershed effects analysis. All monitoring results would be compiled and submitted to the Water Board as part of an Annual Report, due July 15th. Any violations of the waiver, such as a major road or skid trail failure, would be reported to the Water Board by telephone within 48 hours of detection. A written report regarding such violation(s) would be submitted within 14 days.

Implementation Monitoring

Implementation monitoring would be conducted throughout the sale area to determine if BMPs and management requirements have been properly put in place before the start of the winter period (November 15th through April 1st). This monitoring would be completed through the use of Water Quality BMP checklists. Completed checklists would be submitted along with sale area maps to the Water Board as part of the Annual Report.

Effectiveness Monitoring

Effectiveness monitoring would be conducted to determine whether hillslope conditions created by timber operations are resulting in instream conditions that comply with water quality objectives and protect instream beneficial uses of water, or if new sediment sources have developed. Effectiveness monitoring would be conducted as soon as possible following the winter period.

Effectiveness monitoring would be led by a hydrologist, soil scientist, and/or approved soil/hydrologic technician to determine if BMPs and management requirements were effective at preventing significant pollution during the winter period. This monitoring would be required for the King Fire Restoration Project in the following watersheds that exceed the TOC:

- Big Grizzly Canyon

- Brush Creek
- Headwaters Slab Creek
- Lower Silver Creek
- Pilot Creek – Stumpy Meadows Reservoir
- Rubicon River – Ellicott Bridge
- Rubicon River – Leonardi Springs
- Rubicon River – Pigeon Roost Canyon
- Rubicon River – Stoney Creek
- Silver Creek – Camino Reservoir
- Soldier Creek
- South Fork American River – Fresh Pond Ravine
- South Fork American River – Slab Creek Reservoir
- Wallace Canyon

Visual hillslope or visual instream monitoring would be required as part of the effectiveness monitoring. This requirement would be completed through use of the Forest Service Region 5 Best Management Practice Evaluation Program (BMPEP). Only sites in which activities occurred the previous field season would be considered for evaluation. A list of eligible monitoring sites would be created each year, and actual monitoring locations would be selected randomly from the list of eligible sites. Sites that were evaluated and rated as “not implemented” or “not effective” would be revisited the following year to determine if corrective actions have been taken.

An effectiveness monitoring map would be created which displays GPS waypoints of all locations monitored. This map, copies of the BMPEP data sheets, and a brief summary report of the effectiveness monitoring results would be submitted to the Water Board as part of the Annual Report.

Forensic Monitoring

Forensic monitoring would be conducted by a hydrologist, soil scientist, and/or approved soil/hydrologic technician to determine if significant pollution occurred during the winter period as a result of timber harvest activities. This monitoring would be required in watersheds that exceed the TOC. The same watersheds listed above for effectiveness monitoring would also require forensic monitoring.

The Water Board requires forensic monitoring to take place at least two times during the winter period, as follows:

- Once, during or within 12 hours following a 24-hour storm event of at least 2 inches (of rainfall) and after 5 inches (of total precipitation) has accumulated after November 15 and before April 1. Inspections that cannot be conducted during or within 12 hours of such a storm event (due to worker safety, access, or other uncontrollable factors) shall be conducted as soon as possible thereafter.
- Once, during or within 12 hours following a 24-hour storm event of at least 2 inches (of rainfall) and after 15 inches (of total precipitation) has accumulated after November 15 and before April 1. Inspections that cannot be conducted during or within 12 hours of such a storm event (due to worker safety, access, or other uncontrollable factors) shall be conducted as soon as possible thereafter.

In high elevation areas precipitation may be dominated by snow and be inaccessible. In such situations, forensic monitoring would be conducted during spring runoff, as this is the time when erosion is most likely.

Additional Forensic Monitoring shall be conducted if the following “observation trigger” occurs:

- A noticeable significant discharge of sediment is observed in any Class I or Class II watercourse. Photo-point monitoring shall be conducted when such discharge is the result of failed water quality protection management measure(s) or lack of implementation of such measure(s).

Best Management Practices Evaluation Program

Region 5 of the US Forest Service (USFS) has developed a BMPEP for all Forests in the region. The objectives of this program are to: 1) fulfill USFS monitoring commitments to the State Water Resources Control Board (SWRCB), as described in the SWRCB/USFS Management Agency Agreement and *Water Quality Management for National Forest System Lands in California*; 2) assess and document the efficacy of the USFS water quality management program, specifically the implementation and effectiveness of BMPs; and 3) facilitate adaptive management by identifying program shortcomings. In addition, National BMPs have recently been developed, and these require annual monitoring as well.

BMPEPs are assigned to each Forest annually. All sites eligible for evaluation are compiled in a spreadsheet, and then actual evaluation sites are selected randomly. All activities associated with the King Fire Restoration Project would be eligible for evaluation as part of this program. Therefore, additional BMP monitoring, beyond that described above for implementation, effectiveness, and forensic monitoring, is anticipated within this project area.

Stream Condition Inventory Monitoring

The Forest Service Region 5 Water Quality Management Handbook (WQMH) includes requirements for project-level monitoring in watersheds that are at or above thresholds of concern, as determined during the cumulative watershed effects analysis. This includes both hillslope and in-channel monitoring.

Hillslope monitoring requirements would be met by the effectiveness monitoring described in this plan. In-channel monitoring would be completed following the Stream Condition Inventory (SCI) protocol. The WQMH specifies that SCI surveys would be made at the nearest suitable reach downstream of the project area.

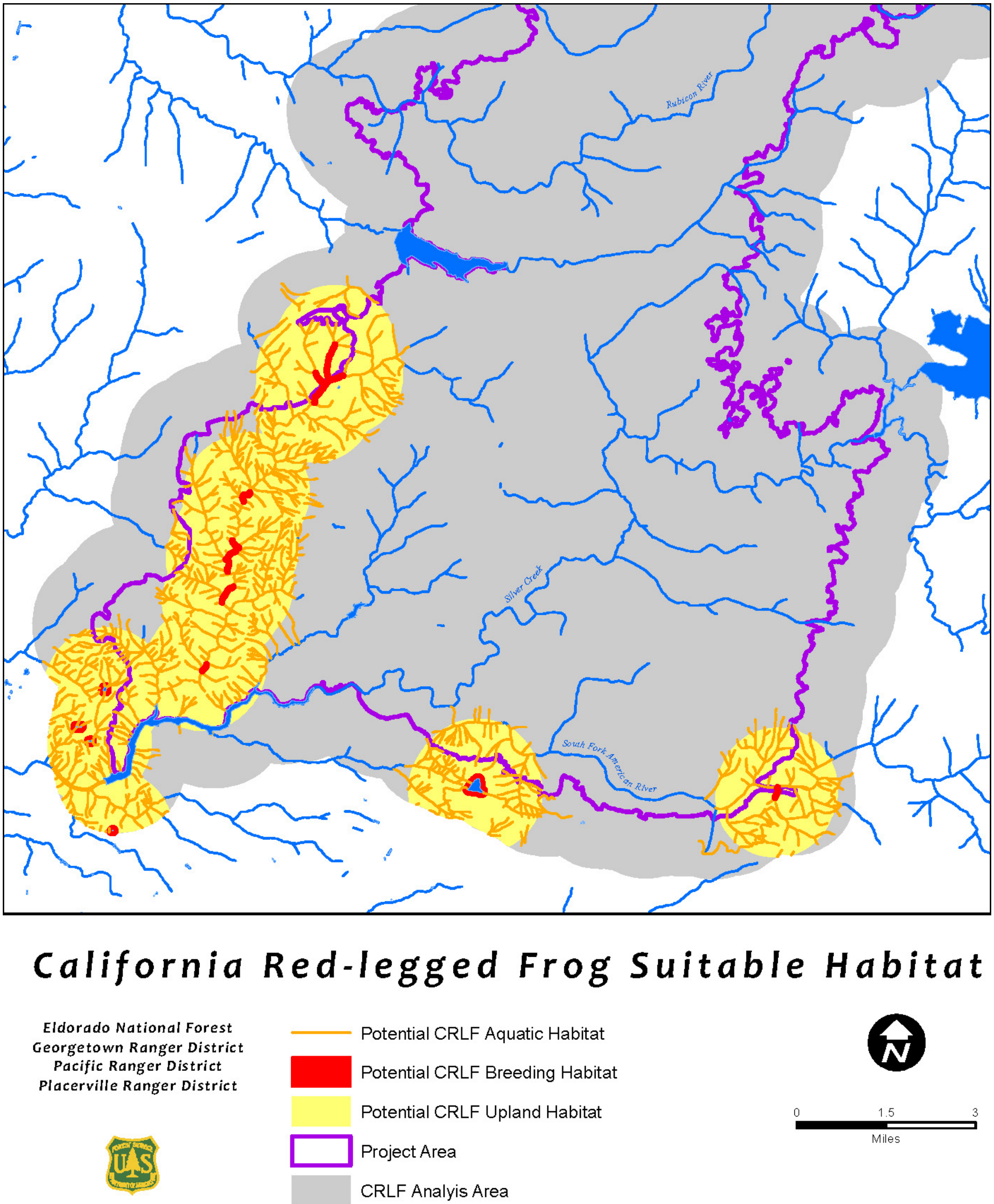
SCI survey reaches would be established before any ground-disturbing activities occur. SCI reaches would be resurveyed following project implementation. SCI survey results would be compared to BMPEP results to evaluate relations between BMP effectiveness and stream-channel responses.

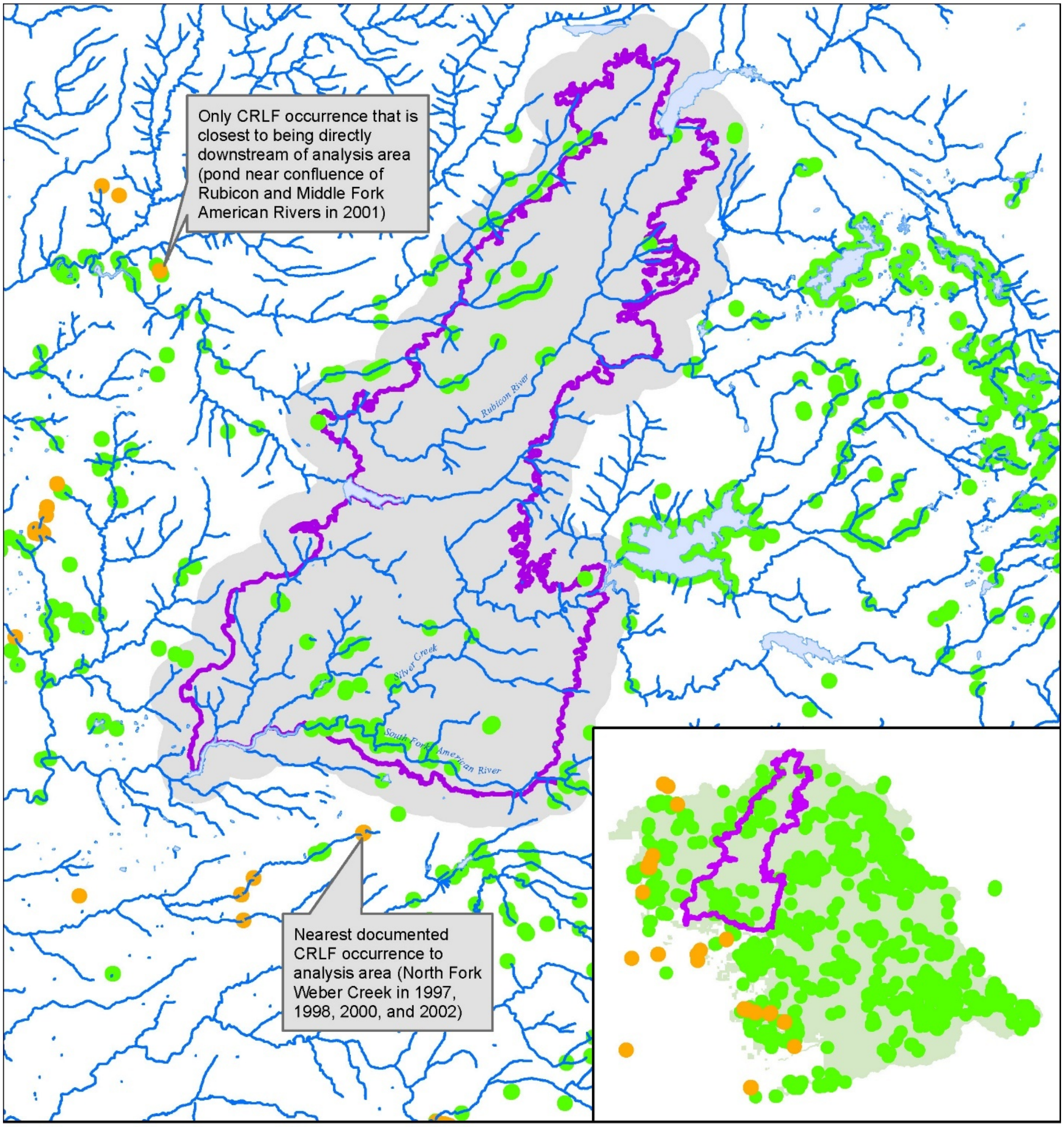
Water Quality Best Management Practices Implementation Checklist

The Forest Service Region 5 WQMH includes requirements for BMP implementation monitoring of all projects with the potential to adversely affect water quality using a “checklist” approach. BMP implementation checklists would document whether and when the site-specific BMPs specified in the NEPA analyses were implemented. The checklists would be the primary systematic means for early detection of potential water quality problems, and would be completed early enough to allow corrective actions to be taken, if needed, prior to any significant rainfall or snowmelt throughout the duration of the project. Depending on the BMP, checklists may be completed prior to ground-disturbing activities, prior to winter periods, and/or at the completion of the project.

Forest Service project staff (Hydrologist, Soil Scientist, Timber Sale Administrators, Engineers, Technicians, etc.) would complete the checklists. A Soil Scientist or Hydrologist would coordinate and review the checklists to ensure that any deficiencies are corrected effectively. All checklists that are part of timber sales would be kept on the Forest as part of the project record and submitted in the Annual Report to the Water Board to meet the requirements of the timber harvest waiver.

Appendix L – Aquatic Wildlife Maps



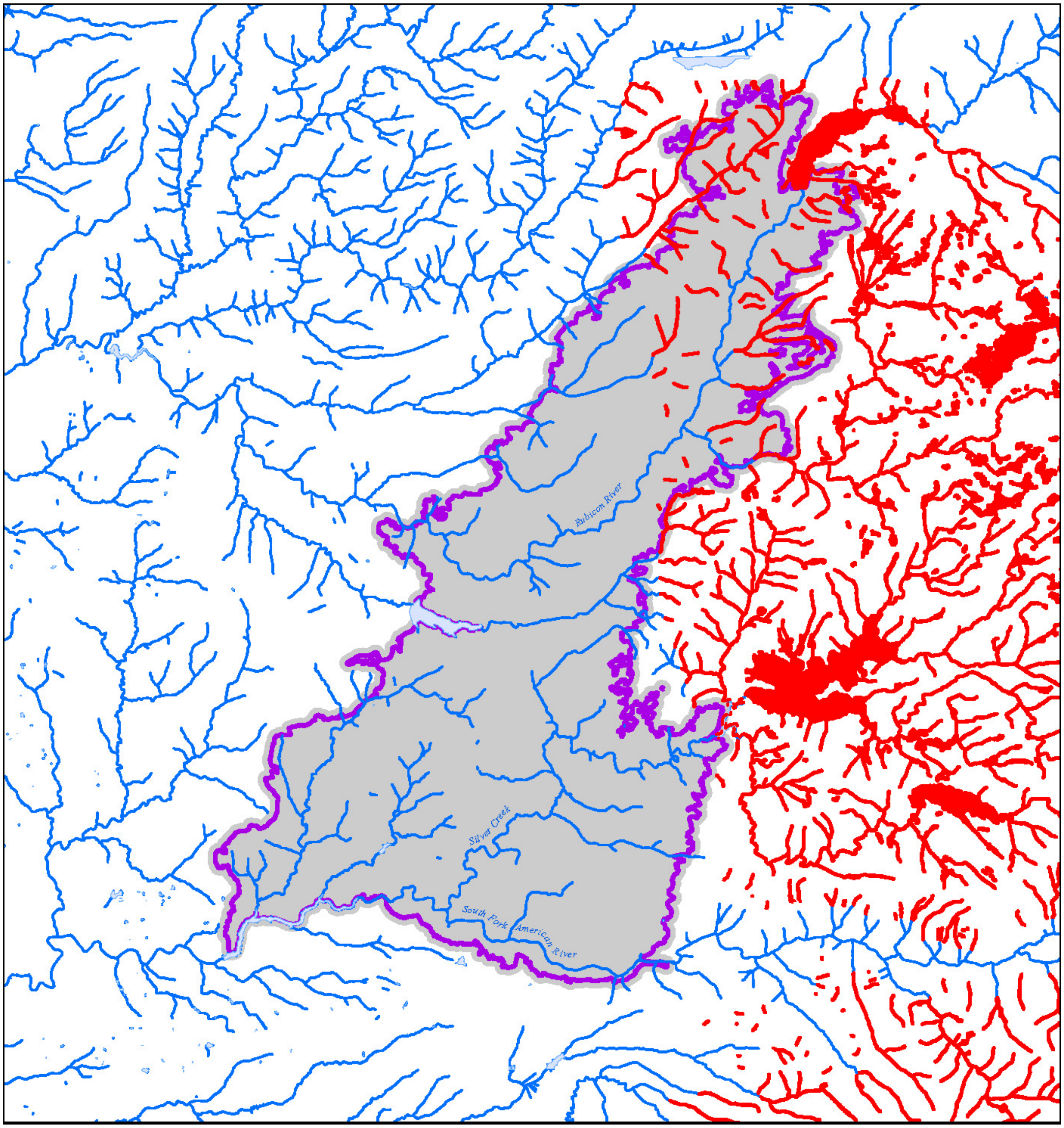


California Red-legged Frog Occurrences

Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District

CRLF occurrences
ENF amphibian/reptile records
Project Area
CRLF Analyis Area

0 3 6
Miles

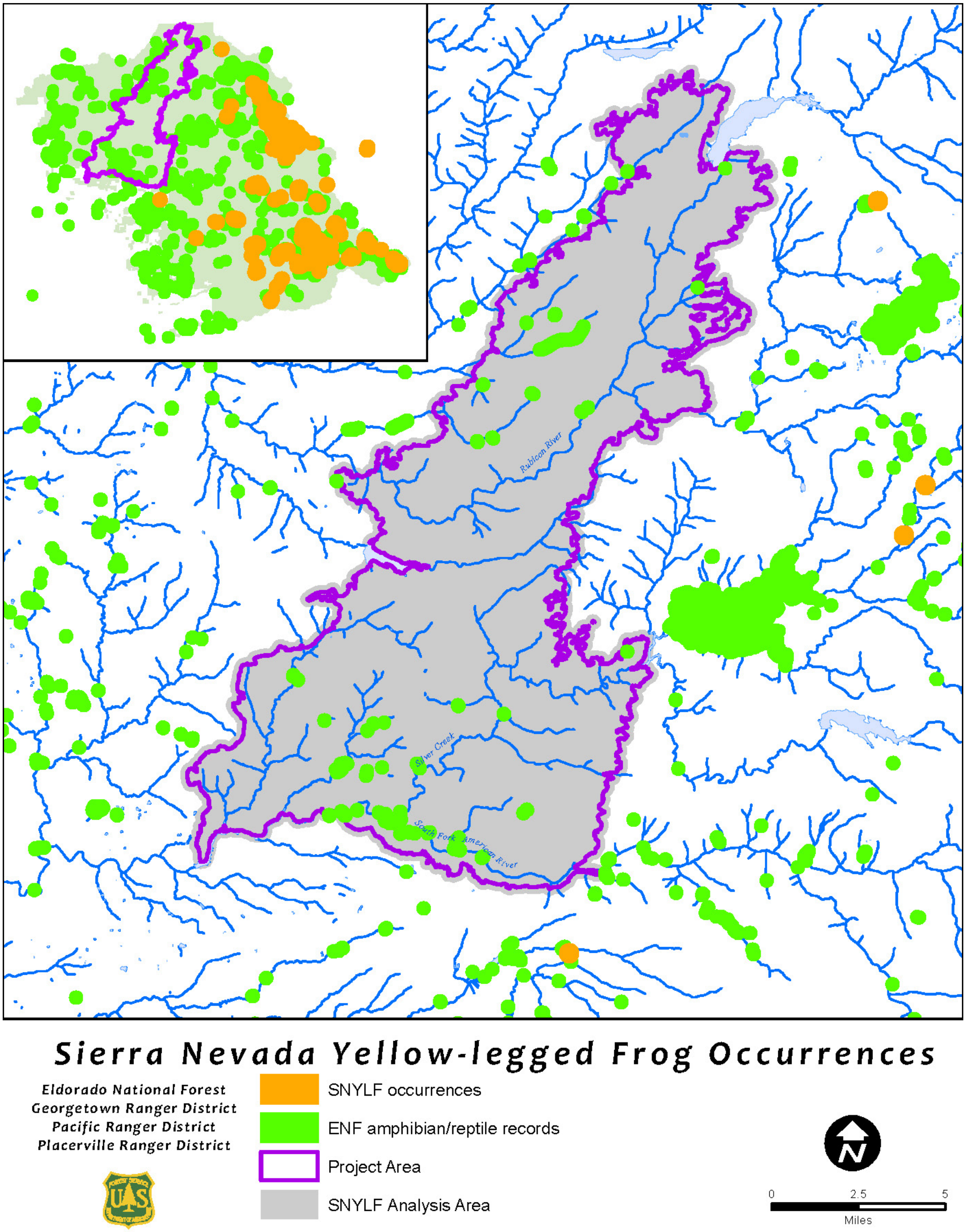


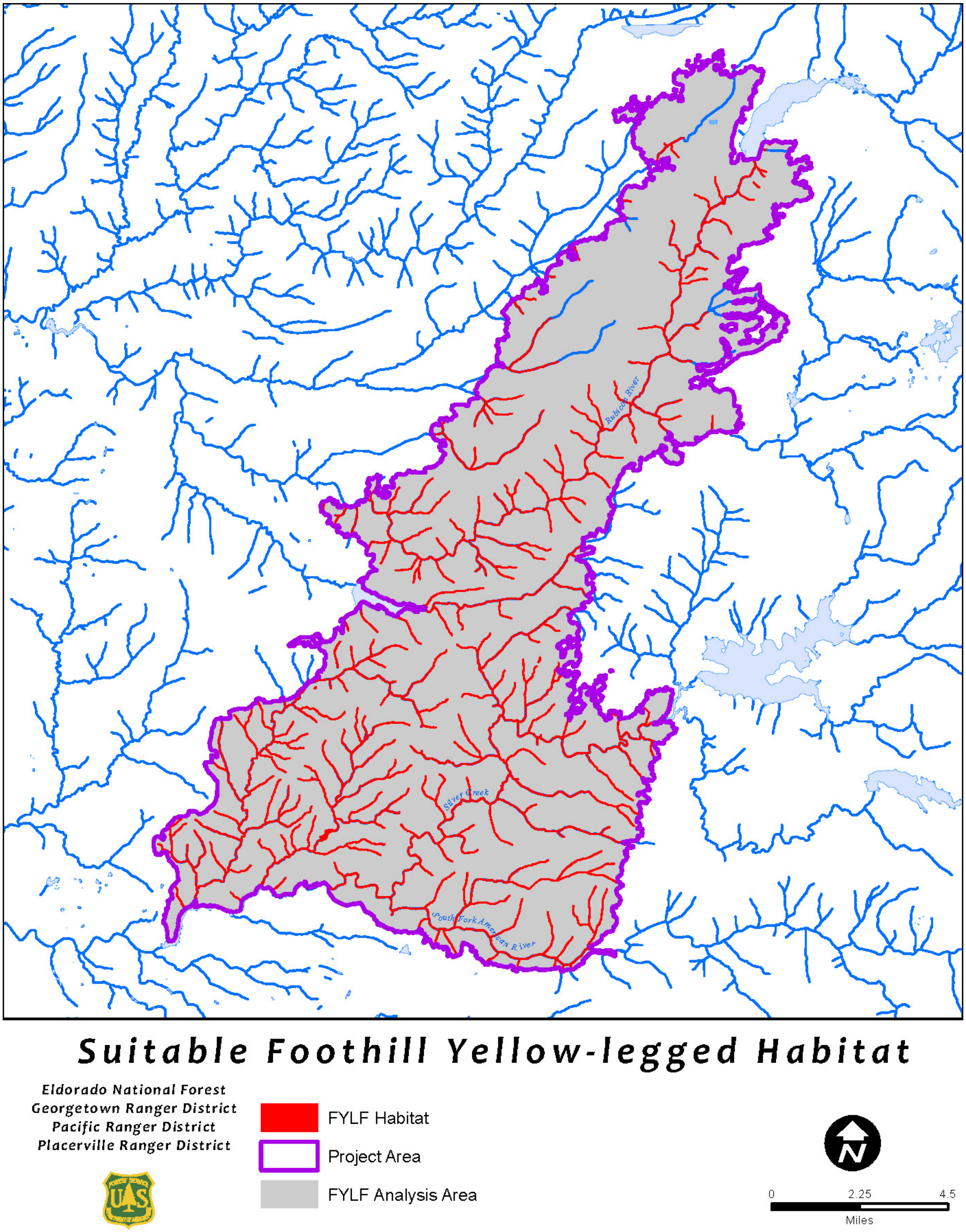
SNYLF Suitable Habitat

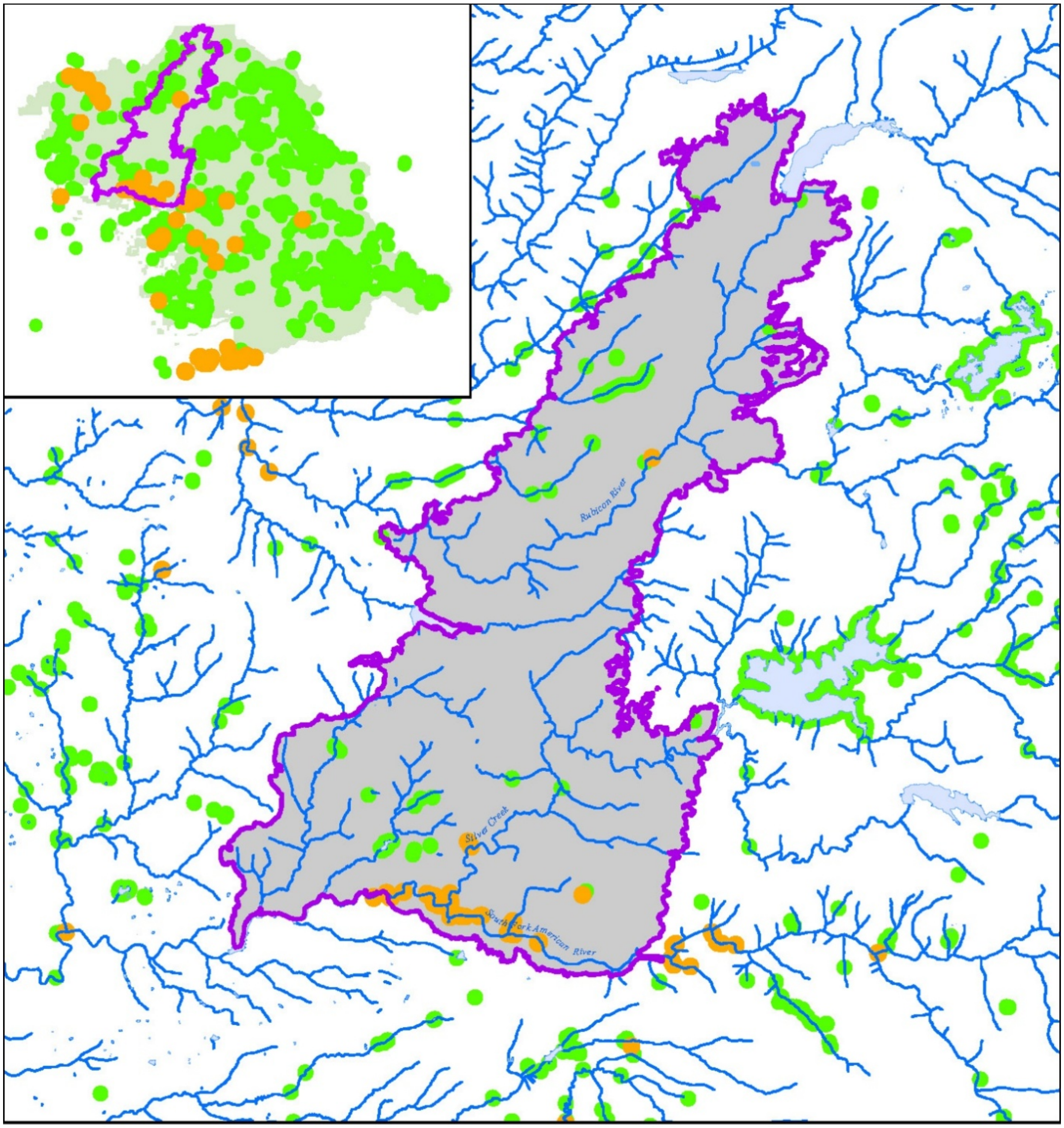
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District

SNYLF Suitable Habitat
Project Area
SNYLF Analysis Area

0 2.5 5
Miles


Rubicon River
Silver Creek
South Fork American River
Sierra Nevada Yellow-legged Frog Occurrences
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
SNYLF occurrences
ENF amphibian/reptile records
Project Area
SNYLF Analysis Area
N
0
2.5
5
Miles


Rubicon River
Silver Creek
South Fork American River
Suitable Foothill Yellow-legged Habitat
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
FYLF Habitat
Project Area
FYLF Analysis Area
0
2.25
4.5
Miles

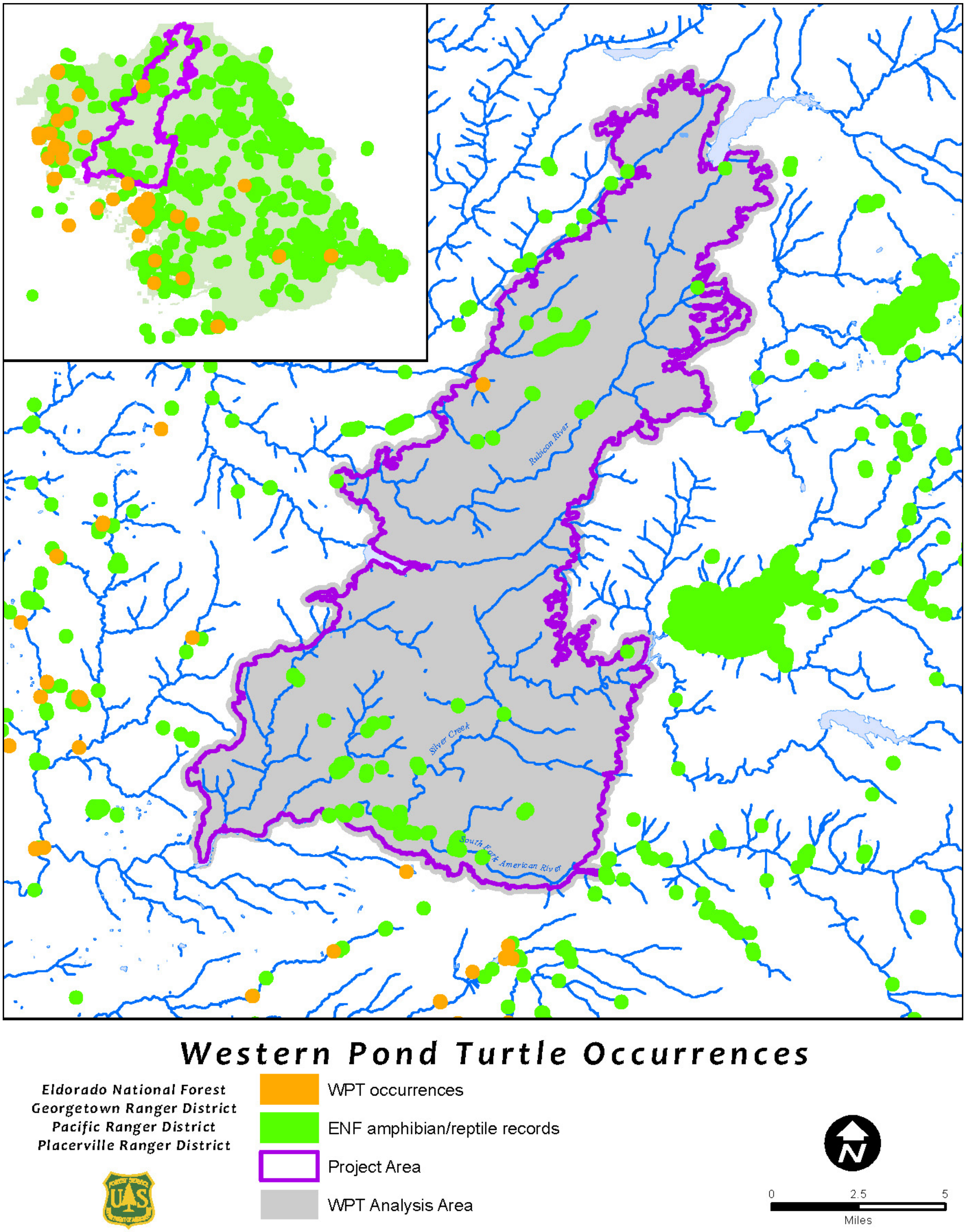


Foothill Yellow-legged Frog Occurrences

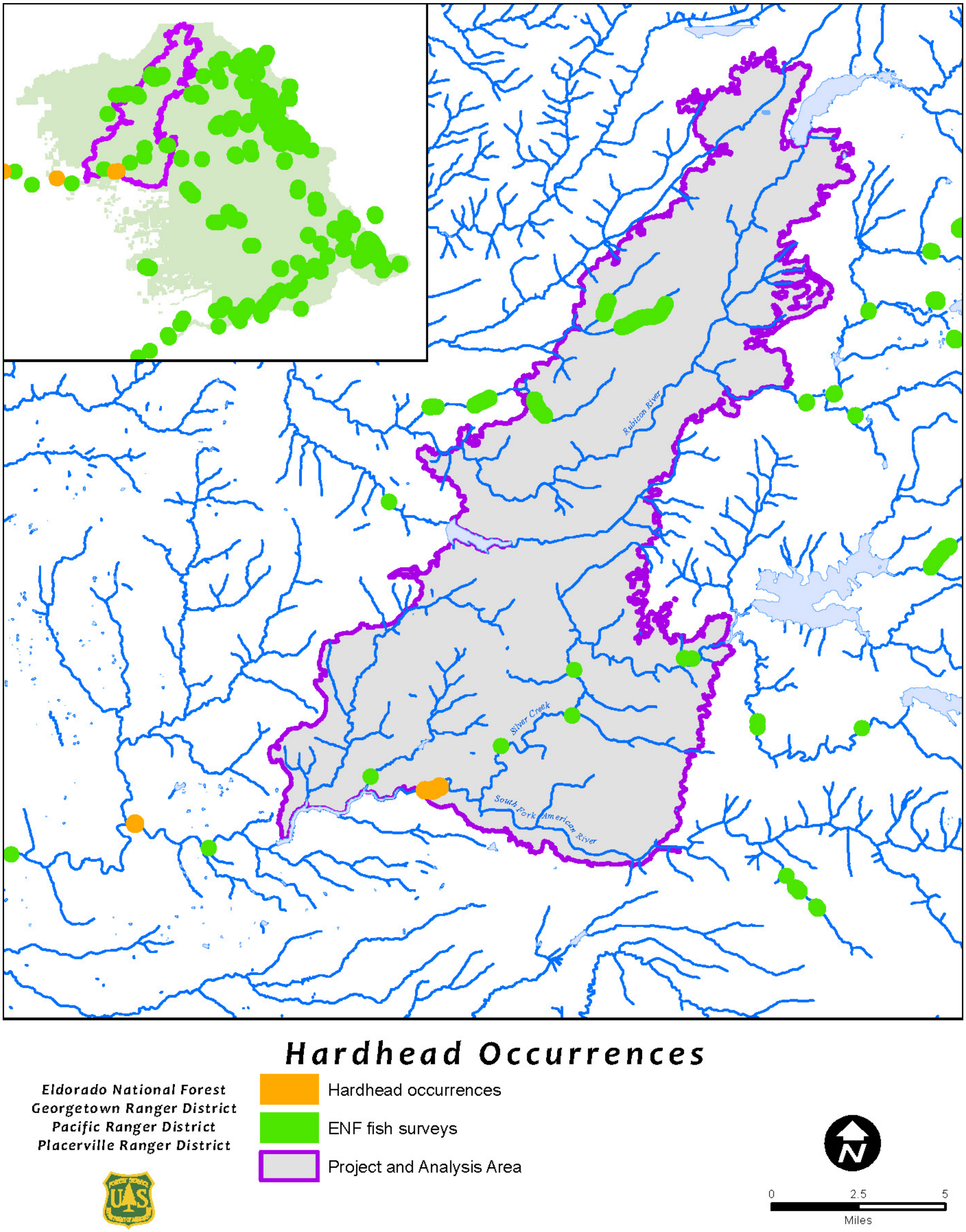
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District

FYLF occurrence
ENF amphibian/reptile records
Project Area
FYLF Analysis Area

0 2.5 5
Miles



Western Pond Turtle Occurrences


Rubicon River
Silver Creek
South Fork American River
Hardhead Occurrences
Eldorado National Forest
Georgetown Ranger District
Pacific Ranger District
Placerville Ranger District
Hardhead occurrences
ENF fish surveys
Project and Analysis Area
N
0
2.5
5
Miles

APPENDIX M: King Fire CWHR Reclassification Crosswalk

Current, post-fire forest vegetation was reclassified using a post-fire vegetation conversion guideline. Forest conifer vegetation types that experienced 25-75% in basal area mortality were adjusted in density of vegetation. Conifer areas that exhibited higher than 75% basal area mortality were re-typed as montane chaparral (MCP) with a size class of "1" (1-6" dbh) and a density of "null." Below is the King Fire CWHR reclassification crosswalk[1]:

CWHR Veg Type	Gridcode	% BA Mortality	Post-fire Typing Convention
Sierran Mixed Conifer (SMC) Douglas-Fir (DFR) White Fir (WFR) Red Fir (RFR) Ponderosa Pine (PPN) Jeffrey Pine (JPN) Closed-Cone Pine-Cypress (CPC) Eastside Pine (EPN)	1-3	0-25	No change
	4	25-50	No change in type or size, but density D or M to P, P to S, and S stays S
	5	50-75	No change in type or size class, but density D or M or P to S, and S stays S
	6	75-90	Change type to MCP, but size to 1 and density to "null"
	7	> 90	Change type to MCP, but size to 1 and density to "null"
Montane Hardwood-Conifer (MHC)	1-3	0-25	No change
	4	25-50	No change in type or size, but density D to M, M to P, P to S, and S stays S
	5	50-75	No change in type or size, but density D or M to S, P or S to S
	6	75-90	No change in type, but size to 1 and density D or M or P to S
	7	> 90	No change in type, but size to 1 and density D or M or P to S
Perennial Grassland (PGS) Cropland (CRC) Vineyard (VIN) Mixed Chaparral (MCH) Montane Chaparral (MCP) Wet Meadow (WTM) Pasture (PAS) Annual Grassland (AGS) Barren (BAR) Urban (URB) Water (WAT)	1-7	0-100	No Change
Blue Oak Woodland (BOW) Blue Oak-Foothill Pine (BOP) Montane Riparian (MRI) Montane Hardwood (MHW) Coastal Oak Woodland (COW)	1-3	0-25	No change
	4	25-50	No change in type or size, but density D or M to P, P to S, and S stays S
	5	50-75	No change in type or size, but density D or M to S, P or S stays S
	6	75-90	No change in type, but size to 1 and density D or M or P to S
	7	> 90	No change in type, but size to 1 and density D or M or P to S

[1] Assumptions in this table are based on the professional expertise of Pacific Southwest Region Silviculturist Joe Sherlock.